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4

EP 99/7616

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The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. Patent application No. Demande de brevet n°

99810514.2

PRIORITY DOCUMENT

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Der Präsident des Europäischen Patentamts:
Im Auftrag

For the President of the European Patent Office

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C. PASTUREL

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LA HAYE, LE

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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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Application no.: 99810514.2
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Ciba Specialty Chemicals Holding Inc.
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SWITZERLAND

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Title of the invention:
Titre de l'invention:
Colour photographic material

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

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Colour Photographic Material

The present invention relates to colour photographic material comprising a certain lacton (benzofuran-2-one) type compound, to the use of this compound as an additive to photographic material, especially as scavenger for the oxidised form of the developer (Dox-scavenger), to some new compounds of the benzofuran-2-one class, and their use as stabilisers for organic material against oxidative, thermal and/or light-induced degradation.

It is well known that one of the problems associated with colour photography is the diffusion of the oxidised colour developer away from the light sensitive silver halide emulsion layer in which it is formed into another silver halide emulsion layer, which can result in the formation of unwanted dyes at undesired places. For instance, while being generated in the green sensitive layer and forming a magenta dye through a coupling reaction with the incorporated magenta coupler, the oxidised developer can also diffuse to the red sensitive layer thereby producing unwanted cyan dye or to the blue sensitive layer thereby producing unwanted yellow dye. This kind of colour formation in the wrong layers will damage the colour balance of the photographic image and thus result in poor colour reproduction. One way of circumventing this problem is to incorporate oxidised developer scavengers in interlayers between the light sensitive silver halide emulsion layers. These scavengers should have additional properties such as low tendency to migrate, good stability towards aerial oxidation and high solublity in photographic oils.

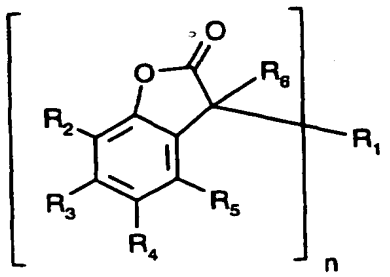
Several classes of compounds that are useful as scavengers for oxidised developers are known in literature, e.g. specific derivatives of hydroquinone (US-2336327, US-2732300, US-3700453, US-4345016, JP-A 83-021249, JP-A 86-083 536 and JP-A 88-046 451); hydrazines (EP-A-338 785, EP-A-679 944, US-4923 787); sulphonamidophenol (EP-A-654702, US-4447523, JP-A 85-118 835); gallic acid (US-4476219, US-4474874, JP-A 93-002 249, JP-A 86-083 536); resorcinol (US-3770431, US-3772014); catechol (US-4175969, US-4252893, EP-A-727706); aminophenol or aminonaphthol (RD 178, 94-7,1979); natural antioxidants such as vitamin E or vitamin C (US-2360290, US-2710801).

Photographic material containing a certain type of benzofuran-2-one is mentioned in US-3615521 (use as precursor of photographic developing agent) and in US-4366240 (hydroxy substituted compounds as electron donor precursors for reducible color providing

compounds). A defensive publication US 904 003 (19.11.1971) discloses some aryl-benzofuran-2-ones as competitive couplers for use in photographic developer compositions or in light sensitive silver halide emulsion layers. DE-A-197 49 083 mentions the use of a symmetrically substituted 3-(2-hydroxyphenyl)-benzofuran-2-one in the interlayer of a colour photographic material.

It has now been found that certain compounds of the 3-aryl-benzofuran-2-one class are especially useful as additives to photographic material. They are effective in a number of applications and find utility, for example, as scavengers for the oxidised developer (also termed hereafter Dox scavengers), as dye stabilisers, as antioxidants or as antifoggants. Liquid compounds of the below formula I can also be used as a photographic oil. These compounds are especially stable towards aerial oxidation, diffusion fast and also exhibit a good solubility in high boiling photographic oils. They are well suited for use in photographic elements containing pyrazolotriazole couplers as magenta dye providing compounds, since they are harmless to the light fastness of magenta images obtained from such pyrazolotriazole couplers when compared to hydroquinones.

Primary subject of the invention is a process for preventing migration of the oxidised developer in a colour photographic material from one colour sensitive layer to another by incorporating a compound of the formula I into said material

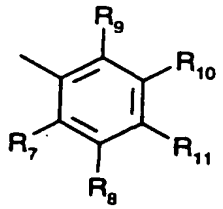


(I),

wherein, if n = 1,

R_1 is naphthyl, phenanthryl, anthryl, 5,6,7,8-tetrahydro-2-naphthyl, 5,6,7,8-tetrahydro-1-naphthyl, thienyl, benzo[b]thienyl, naphtho[2,3-b]thienyl, thianthrenyl, dibenzofuryl, chromenyl, xanthenyl, phenoxathiinyl, pyrrolyl, imidazolyl, pyrazolyl, pyrazinyl, pyrimidinyl, pyridazi-

nyl, indolizinyl, isoindolyl, indolyl, indazolyl, purinyl, quinolizinyl, isoquinolyl, quinolyl, phthalazinyl, naphthyridinyl, quinoxalinyl, quinazolinyl, cinnolinyl, pteridinyl, carbazolyl, β-carbolinyl, phenanthridinyl, acridinyl, perimidinyl, phenanthrolinyl, phenazinyl, isothiazolyl, phenothiazinyl, isoxazolyl, furazanyl, biphenyl, terphenyl, fluorenyl or phenoxazinyl, each of which is unsubstituted or substituted by C_1-C_4alkyl, C_1-C_4alkoxy, C_1-C_4alkylthio, hydroxy, halogen, amino, C_1-C_4alkylamino, phenylamino or di(C_1-C_4-alkyl)amino, or R_1 is a radical of formula II



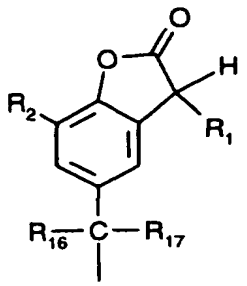
(II),

and, if n = 2,

R_1 is unsubstituted or C_1-C_4alkyl- or hydroxy-substituted phenylene or naphthylene; or $-R_{12}-X-R_{13}-$,

R_2, R_3, R_4 and R_5 are each independently of one another hydrogen, chloro, hydroxy, C_1-C_{25}-alkyl, C_7-C_9phenylalkyl, unsubstituted or C_1-C_4alkyl-substituted phenyl; unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkyl; C_1-C_{18}alkoxy, C_1-C_{18}alkylthio, C_1-C_4alkylamino, di(C_1-C_4-alkyl)amino, C_1-C_{25}alkanoyloxy, C_1-C_{25}alkanoylamino, C_3-C_{25}alkenoyloxy;

C_3-C_{25}alkanoyloxy which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_6-C_9cycloalkyl-carbonyloxy, benzoyloxy or C_1-C_{12}alkyl-substituted benzoyloxy; or R_2 and R_3, or R_3 and R_4, or R_4 and R_5, together with the linking carbon atoms, form a benzene ring; or R_4 is $-C_mH_{2m}-COR_{15}$ or $-(CH_2)_qOH$ or, if R_3, R_5 and R_6 are hydrogen, R_4 is additionally a radical of formula III

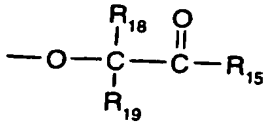
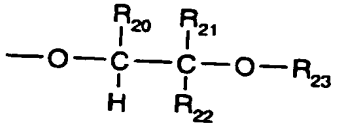


(III),

wherein R_1 is as defined above for n = 1;

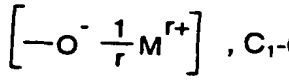
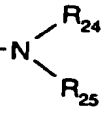
R_6 is hydrogen or, when R_4 is hydroxy, R_6 can also be C_1-C_{25}alkyl or C_3-C_{25}alkenyl;

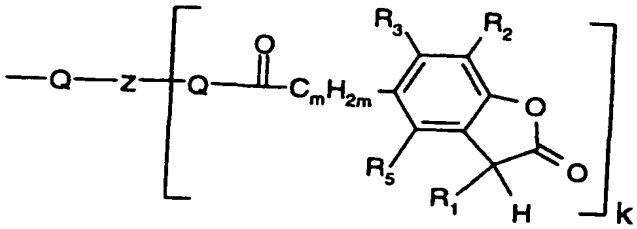
R_7, R_8, R_9, R_{10} and R_{11} are each independently of one another hydrogen, halogen, hydroxy, C_1-C_{25}alkyl; C_2-C_{25}alkyl which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_1-C_{25}alkoxy; C_2-C_{25}alkoxy which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_1-C_{25}alkylthio, C_3-C_{25}-alkenyl, C_3-C_{25}alkenyloxy, C_3-C_{25}alkynyl, C_3-C_{25}alkynyloxy, C_7-C_9phenylalkyl, C_7-C_9phenylalkoxy, unsubstituted or C_1-C_4alkyl-substituted phenyl; unsubstituted or C_1-C_4alkyl- substituted phenoxy; unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkyl; unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkoxy; C_1-C_4alkylamino, di(C_1-C_4alkyl)amino, C_1-C_{25}alkanoyl; C_3-C_{25}alkanoyl which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_1-C_{25}alkanoyloxy; C_3-C_{25}alkanoyloxy which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_1-C_{25}alkanoylamino, C_3-C_{25}alkenoyl; C_3-C_{25}alkenoyl which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_3-C_{25}alkenoyloxy; C_3-C_{25}alkenoyloxy which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_6-C_9cycloalkylcarbonyl, C_6-C_9cycloalkylcarbonyloxy, benzoyl or C_1-C_{12}alkyl-substituted benzoyl; benzoyloxy or C_1-C_{12}alkyl-substituted benzoyloxy;

 or  or, in formula II, R_7 and R_8, or R_8 and R_{11}, together with the linking carbon atoms, form a benzene ring,

R_{12} and R_{13} are each independently of the other unsubstituted or C_1-C_4alkyl-substituted phenylene or naphthylene,

R_{14} is hydrogen or C_1-C_8alkyl,

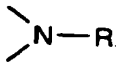
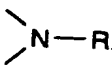
R_{15} is hydroxy,  , C_1-C_{20}alkoxy,  , or a group of the formula IIIa

 (IIIa);

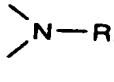
R_{16} and R_{17} are each independently of the other hydrogen, CF_3, C_1-C_{12}alkyl or phenyl, or R_{16} and R_{17}, together with the linking carbon atom, are a C_5-C_8cycloalkylidene ring which is unsubstituted or substituted by 1 to 3 C_1-C_4alkyl;

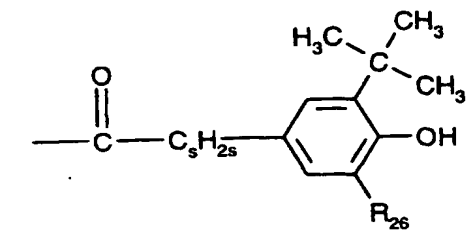
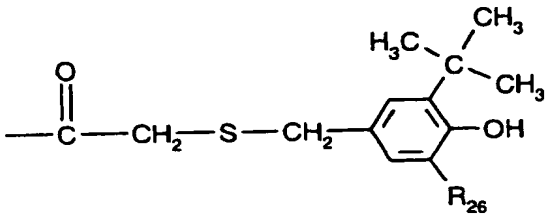
R_{18} and R_{19} are each independently of the other hydrogen, C_1-C_4alkyl or phenyl,

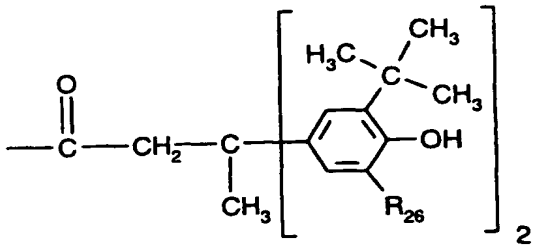
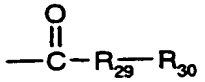
R_{20} is hydrogen or C_1-C_4alkyl,

R_{21} is hydrogen, unsubstituted or C_1-C_4alkyl-substituted phenyl; C_1-C_{25}alkyl; C_2-C_{25}alkyl which is interrupted by oxygen, sulfur or  ; C_7-C_9phenylalkyl which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C_1-C_4alkyl; C_7-C_{25}phenylalkyl which is interrupted by oxygen, sulfur or  and which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C_1-C_4alkyl, or R_{20} and R_{21}, together with the linking carbon atoms, form a C_5-C_{12}cycloalkylene ring which is unsubstituted or substituted by 1 to 3 C_1-C_4alkyl;

R_{22} is hydrogen or C_1-C_4alkyl,

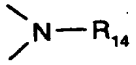
R_{23} is hydrogen, C_1-C_{25}alkanoyl, C_3-C_{25}alkenoyl; C_3-C_{25}alkanoyl which is interrupted by oxygen, sulfur or  ; C_2-C_{25}alkanoyl which is substituted by a di(C_1-C_6alkyl)phos-

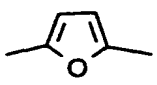
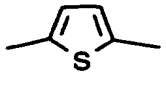
phonate group; C_6-C_9cycloalkylcarbonyl, thenoyl, furoyl, benzoyl or C_1-C_{12}alkyl-substituted benzoyl;  ,  ,

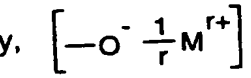
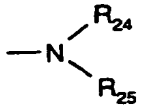
 ,  or  ,

R_{24} and R_{25} are each independently of the other hydrogen or C_1-C_{18}alkyl,

R_{26} is hydrogen or C_1-C_8alkyl,

R_{27} is a direct bond, C_1-C_{18}alkylene; C_2-C_{18}alkylene which is interrupted by oxygen, sulfur or  ; C_2-C_{18}alkenylene, C_2-C_{20}alkylidene, C_7-C_{20}phenylalkylidene, C_5-C_8cycloalkylene, C_7-C_8bicycloalkylene, unsubstituted or C_1-C_4alkyl-substituted phenylene,

 or  ,

R_{28} is hydroxy,  , C_1-C_{18}alkoxy or  ,

R_{29} is oxygen or -NH-,

R_{30} is C_1-C_{18}alkyl or phenyl,

R_{31} is hydrogen or C_1-C_{18}alkyl,

M is an r-valent metal cation,

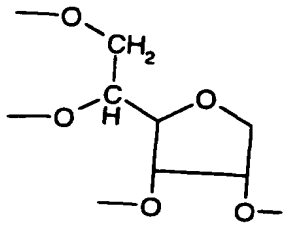
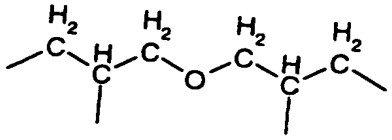
Q is oxygen or -NH-,

X is a direct bond, oxygen, sulfur or $-NR_{31}-$,

Z is a linking group of valency (k+1) and is as a divalent group C_2-C_{12}alkylene, Q-interrupted C_4-C_{12}alkylene, phenylene or phenylene-D-phenylene with D being C_1-C_4alkylene, O, S, SO or SO_2;

Z as a trivalent group is C_3-C_{12}alkanetriyl, a trivalent residue of a hexose or a hexitol, a group $(-CH_2)_3C-CH_2OH$, or a group $-C_aH_{2a}-N(C_bH_{2b}-)-C_cH_{2c}-$; and

Z as a tetravalent group is a tetravalent residue of a hexose or a hexitol, C_4-C_{12}alkanetetryl,

a group  or a group  ;

a, b, c and k independently are 1, 2 or 3;

m is 0 or a number from the range 1-12, preferably 1-6;

n is 1 or 2;

q is 1, 2, 3, 4, 5 or 6;

r is 1, 2 or 3; and

s is 0, 1 or 2;

provided that, when R_7 is hydroxy, alkanoyloxy or alkanoyloxy interrupted by O, S or $N(R_{14})$ and R_9 is hydrogen, R_{10} is not identical with R_4; and when R_9 is hydroxy, alkanoyloxy or alkanoyloxy interrupted by O, S or $N(R_{14})$ and R_7 is hydrogen, R_8 is not identical with R_4.

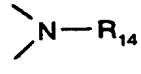
R_1 is preferably a radical of formula II. These preferred compounds of formula I advantageously carry at least one hydrocarbon or substituted hydrocarbon radical R_2, R_3, R_4, R_5, R_7, R_8, R_9, R_{10} and/or R_{11}, where the total number of carbon atoms in all radicals together is at least 3. More preferred compounds comprise one or more substituents among R_2-R_5 and R_7-R_{11}, wherein the total number of carbon atoms in all substituents together is 4-35, especially 7-30.

Further objects of the invention are the use of a compound of the formula I in colour photographic material, especially as Dox-scavenger, and a photographic material containing a compound of the formula I, especially as herein defined below, e.g. of formula IV.

Preferred residues of the classes naphthyl, phenanthryl, anthryl, 5,6,7,8-tetrahydro-2-naphthyl, 5,6,7,8-tetrahydro-1-naphthyl, thienyl, benzo[b]thienyl, naphtho[2,3-b]thienyl, thianthrenyl, dibenzofuryl, chromenyl, xanthenyl, phenoxathiinyl, pyrrolyl, imidazolyl, pyrazolyl, pyrazinyl, pyrimidinyl, pyridazinyl, inddizinyl, isoindolyl, indolyl, indazolyl, purinyl, quinolizinyl, isoquinolyl, quinolyl, phthalazinyl, naphthyridinyl, quinoxalinyl, quinazolinyl,

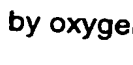
cinnolinyl, pteridinyl, carbazolyl, β-carbolinyl, phenanthridinyl, acridinyl, perimidinyl, phenanthrolinyl, phenazinyl, isothiazolyl, phenothiazinyl, isoxazolyl, furazanyl, biphenyl, terphenyl, fluorenyl or phenoxazinyl, each of which is unsubstituted or substituted by C_1-C_4alkyl, C_1-C_4alkoxy, C_1-C_4alkylthio, hydroxy, halogen, amino, C_1-C_4alkylamino, phenylamino or di(C_1-C_4alkyl)amino are, for example, 1-naphthyl, 2-naphthyl, 1-phenylamino-4-naphthyl, 1-methylnaphthyl, 2-methylnaphthyl, 1-methoxy-2-naphthyl, 2-methoxy-1-naphthyl, 1-dimethylamino-2-naphthyl, 1,2-dimethyl-4-naphthyl, 1,2-dimethyl-6-naphthyl, 1,2-dimethyl-7-naphthyl, 1,3-dimethyl-6-naphthyl, 1,4-dimethyl-6-naphthyl, 1,5-dimethyl-2-naphthyl, 1,6-dimethyl-2-naphthyl, 1-hydroxy-2-naphthyl, 2-hydroxy-1-naphthyl, 1,4-dihydroxy-2-naphthyl, 7-phenanthryl, 1-anthryl, 2-anthryl, 9-anthryl, 3-benzo[b]thienyl, 5-benzo[b]thienyl, 2-benzo[b]thienyl, 4-dibenzofuryl, 4,7-dibenzofuryl, 4-methyl-7-dibenzofuryl, 2-xanthenyl, 8-methyl-2-xanthenyl, 3-xanthenyl, 2-pyrrolyl, 3-pyrrolyl, 2-phenothiazinyl, 3-phenothiazinyl, 10-methyl-3-phenothiazinyl.

Halogen is typically chloro, bromo or iodo. Chloro is preferred.

Alkanoyl of up to 25 carbon atoms is a branched or unbranched radical, typically formyl, acetyl, propionyl, butanoyl, pentanoyl, hexanoyl, heptanoyl, octanoyl, nonanoyl, decanoyl, undecanoyl, dodecanoyl, tridecanoyl, tetradecanoyl, pentadecanoyl, hexadecanoyl, heptadecanoyl, octadecanoyl, eicosanoyl or docosanoyl. Alkanoyl of 2 to 18, in particular of 2 to 12, e.g. of 2 to 6, carbon atoms is preferred. Acetyl is particularly preferred. C_2-C_{25}Alkanoyl which is substituted by a di(C_1-C_6alkyl)phosphonate group is typically $(CH_3CH_2O)_2POCH_2CO$-, $(CH_3O)_2POCH_2CO$-, $(CH_3CH_2CH_2CH_2O)_2POCH_2CO$-, $(CH_3CH_2O)_2POCH_2CH_2CO$-, $(CH_3O)_2POCH_2CH_2CO$-, $(CH_3CH_2CH_2CH_2O)_2POCH_2CH_2CO$-, $(CH_3CH_2O)_2PO(CH_2)_4CO$-, $(CH_3CH_2O)_2PO(CH_2)_8CO$- or $(CH_3CH_2O)_2PO(CH_2)_{17}CO$-. C_3-C_{25}Alkanoyl which is interrupted by oxygen, sulfur or  is typically CH_3-O-CH_2CO-, CH_3-S-CH_2CO-, CH_3-NH-CH_2CO-, CH_3-N(CH_3)-CH_2CO-, CH_3-O-CH_2CH_2-O-CH_2CO-, CH_3-(O-CH_2CH_2-)$_2$O-CH_2CO-, CH_3-(O-CH_2CH_2-)$_3$O-CH_2CO- or CH_3-(O-CH_2CH_2-)$_4$O-CH_2CO-.

Alkanoyloxy is oxygen-capped alkanoyl; preferences are mainly as can be derived from alkanoyl above.

Alkenoyl of 3 to 25 carbon atoms is a branched or unbranched radical, typically propenoyl, 2-butenoyl, 3-butenoyl, isobutenoyl, n-2,4-pentadienoyl, 3-methyl-2-butenoyl, n-2-octenoyl, n-2-dodecenoyl, isododecenoyl, oleoyl, n-2-octadecenoyl or n-4-octadecenoyl. Alkenoyl of 3 to 18, preferably of 3 to 12, e.g. of 3 to 6, most preferably of 3 to 4, carbon atoms is preferred.

C_3-C_{25}Alkenoyl which is interrupted by oxygen, sulfur or  is typically

$CH_3OCH_2CH_2CH=CHCO$- or $CH_3OCH_2CH_2OCH=CHCO$-.

Alkenoyloxy is oxygen-capped alkenoyl; preferences are mainly as can be derived from alkenoyl above.

C_6-C_9Cycloalkylcarbonyl is typically cyclohexylcarbonyl, cycloheptylcarbonyl or cyclooctylcarbonyl. Cyclohexylcarbonyl is preferred. C_6-C_9Cycloalkylcarbonyloxy is oxygen-capped cycloalkylcarbonoyl; preferences are analogous.

C_1-C_{12}Alkyl-substituted benzoyl which preferably carries 1 to 3, more preferably 1 or 2, alkyl groups is typically o-, m- or p-methylbenzoyl, 2,3-dimethylbenzoyl, 2,4-dimethylbenzoyl, 2,5-dimethylbenzoyl, 2,6-dimethylbenzoyl, 3,4-dimethylbenzoyl, 3,5-dimethylbenzoyl, 2-methyl-6-ethylbenzoyl, 4-tert-butylbenzoyl, 2-ethylbenzoyl, 2,4,6-trimethylbenzoyl, 2,6-dimethyl-4-tert-butylbenzoyl or 3,5-di-tert-butylbenzoyl. Preferred substituents are C_1-C_8alkyl, in particular C_1-C_4alkyl.

C_1-C_{12}Alkyl-substituted benzoyloxy which preferably carries 1 to 3, more preferably 1 or 2, alkyl groups is typically o-, m- or p-methylbenzoyloxy, 2,3-dimethylbenzoyloxy, 2,4-dimethylbenzoyloxy, 2,5-dimethylbenzoyloxy, 2,6-dimethylbenzoyloxy, 3,4-dimethylbenzoyloxy, 3,5-dimethylbenzoyloxy, 2-methyl-6-ethylbenzoyloxy, 4-tert-butylbenzoyloxy, 2-ethylbenzoyloxy, 2,4,6-trimethylbenzoyloxy, 2,6-dimethyl-4-tert-butylbenzoyloxy or 3,5-di-tert-butylbenzoyloxy. Preferred substituents are C_1-C_8alkyl, in particular C_1-C_4alkyl.

Alkyl of up to 25 carbon atoms is a branched or unbranched radical, such as methyl, ethyl, propyl, isopropyl, n-butyl, sec-butyl, isobutyl, tert-butyl, 2-ethylbutyl, n-pentyl, isopentyl, 1-methylpentyl, 1,3-dimethylbutyl, n-hexyl, 1-methylhexyl, n-heptyl, isoheptyl, 1,1,3,3-tetramethylbutyl, 1-methylheptyl, 3-methylheptyl, n-octyl, 2-ethylhexyl, 1,1,3-trimethylhexyl, 1,1,3,3-tetramethylpentyl, nonyl, decyl, undecyl, 1-methylundecyl, dodecyl, 1,1,3,3,5,5-hexamethylhexyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, eicosyl or do-

cosyl. One of the preferred meanings of R_2 and R_4 is, for example, C_1-C_{18}alkyl. A particularly preferred meaning of R_4 is C_1-C_4alkyl. One of R_2 and R_4 is preferably a branched radical; especially preferred are both R_2 and R_4 branched radicals.

Alkenyl of 3 to 25 carbon atoms is a branched or unbranched radical, such as propenyl, 2-butenyl, 3-butenyl, isobutenyl, n-2,4-pentadienyl, 3-methyl-2-butenyl, n-2-octenyl, n-2-dodecenyl, isododecenyl, oleyl, n-2-octadecenyl or n-4-octadecenyl. Alkenyl of 3 to 18, preferably of 3 to 12, e.g. of 3 to 6, in particular of 3 to 4, carbon atoms is preferred.

Alkenyloxy is oxygen capped alkenyl; preferences are analogous.

Alkynyl of 3 to 25 carbon atoms is a branched or unbranched radical, such as propynyl ($-CH_2-C\equiv CH$), 2-butynyl, 3-butynyl, n-2-octynyl, or n-2-dodecynyl. Alkynyl of 3 to 18, preferably of 3 to 12, e.g. of 3 to 6, in particular of 3 to 4 carbon atoms is preferred. Preferences for alkynyloxy (oxygen capped alkynyl) are analogous.

C_2-C_{25}Alkyl which is interrupted by oxygen, sulfur or $>N-R_{14}$ is typically

CH_3-O-CH_2-, CH_3-S-CH_2-, CH_3-NH-CH_2-, CH_3-N(CH_3)-CH_2-, CH_3-O-CH_2CH_2-O-CH_2-, CH_3-(O-CH_2CH_2-)$_2$-O-CH_2-, CH_3-(O-CH_2CH_2-)$_3$O-CH_2- or CH_3-(O-CH_2CH_2-)$_4$O-CH_2-.

C_7-C_9Phenylalkyl is typically benzyl, α-methylbenzyl, α,α-dimethylbenzyl or 2-phenylethyl. Benzyl and α,α-dimethylbenzyl are preferred.

C_7-C_9Phenylalkyl which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C_1-C_4-alkyl is typically benzyl, α-methylbenzyl, α,α-dimethylbenzyl, 2-phenylethyl, 2-methylbenzyl, 3-methylbenzyl, 4-methylbenzyl, 2,4-dimethylbenzyl, 2,6-dimethylbenzyl or 4-tert-butylbenzyl. Benzyl is preferred.

C_7-C_{25}Phenylalkyl which is interrupted by oxygen, sulfur or $>N-R_{14}$ and which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C_1-C_4alkyl is a branched or unbranched

radical, such as phenoxymethyl, 2-methylphenoxymethyl, 3-methyl-phenoxymethyl, 4-methylphenoxymethyl, 2,4-dimethylphenoxymethyl, 2,3-dimethylphenoxymethyl, phenylthiomethyl, N-methyl-N-phenyl-methyl, N-ethyl-N-phenylmethyl, 4-tert-butylphenoxymethyl, 4-tert-butylphenoxyethoxymethyl, 2,4-di-tert-butylphenoxymethyl, 2,4-di-tert-butylphenoxyethoxymethyl, phenoxyethoxyethoxyethoxymethyl, benzyloxymethyl, benzyloxyethoxymethyl, N-benzyl-N-ethylmethyl or N-benzyl-N-isopropylmethyl.

C_7-C_9Phenylalkoxy is typically benzyloxy, α-methylbenzyloxy, α,α-dimethylbenzyloxy or 2-phenylethoxy. Benzyloxy is preferred.

C_1-C_4Alkyl-substituted phenyl which preferably contains 1 to 3, in particular 1 or 2, alkyl groups is typically o-, m- or p-methylphenyl, 2,3-dimethylphenyl, 2,4-dimethylphenyl, 2,5-dimethylphenyl, 2,6-dimethylphenyl, 3,4-dimethylphenyl, 3,5-dimethylphenyl, 2-methyl-6-ethylphenyl, 4-tert-butylphenyl, 2-ethylphenyl or 2,6-diethylphenyl.

C_1-C_4Alkyl-substituted phenoxy which preferably contains 1 to 3, in particular 1 or 2, alkyl groups is typically o-, m- or p-methylphenoxy, 2,3-dimethylphenoxy, 2,4-dimethylphenoxy, 2,5-dimethylphenoxy, 2,6-dimethylphenoxy, 3,4-dimethylphenoxy, 3,5-dimethylphenoxy, 2-methyl-6-ethylphenoxy, 4-tert-butylphenoxy, 2-ethylphenoxy or 2,6-diethylphenoxy.

Unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkyl is, for example, cyclopentyl, methylcyclopentyl, dimethylcyclopentyl, cyclohexyl, methylcyclohexyl, dimethylcyclohexyl, trimethylcyclohexyl, tert-butylcyclohexyl, cycloheptyl or cyclooctyl. Cyclohexyl and tert-butylcyclohexyl are preferred.

Unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkoxy is, for example, cyclopentoxy, methylcyclopentoxy, dimethylcyclopentoxy, cyclohexoxy, methylcyclohexoxy, dimethylcyclohexoxy, trimethylcyclohexoxy, tert-butylcyclohexoxy, cycloheptoxy or cyclooctoxy. Cyclohexoxy and tert-butylcyclohexoxy are preferred.

Alkoxy of up to 25 carbon atoms is a branched or unbranched radical, such as methoxy, ethoxy, propoxy, isopropoxy, n-butoxy, isobutoxy, pentoxy, isopentoxy, hexoxy, heptoxy, octoxy, decyloxy, tetradecyloxy, hexadecyloxy or octadecyloxy. Alkoxy of 1 to 12, in particular of 1 to 8, e.g. of 1 to 6, carbon atoms is preferred.

C_2-C_{25}Alkoxy which is interrupted by oxygen, sulfur or $>N-R_{14}$ is typically

CH_3-O-CH_2CH_2O-, CH_3-S-CH_2CH_2O-, CH_3-NH-CH_2CH_2O-, CH_3-N(CH_3)-CH_2CH_2O-, CH_3-O-CH_2CH_2-O-CH_2CH_2O-, CH_3-(O-CH_2CH_2-)$_2$O-CH_2CH_2O-, CH_3-(O-CH_2CH_2-)$_3$O-CH_2CH_2O- or CH_3-(O-CH_2CH_2-)$_4$O-CH_2CH_2O-.

Alkylthio of up to 25 carbon atoms is a branched or unbranched radical, such as methylthio, ethylthio, propylthio, isopropylthio, n-butylthio, isobutylthio, pentylthio, isopentylthio, hexylthio, heptylthio, octylthio, decylthio, tetradecylthio, hexadecylthio or octadecylthio. Alkylthio of 1 to 12, in particular of 1 to 8, e.g. of 1 to 6 carbon atoms is preferred.

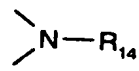
Alkylamino of up to 4 carbon atoms is a branched or unbranched radical, such as methylamino, ethylamino, propylamino, isopropylamino, n-butylamino, isobutylamino or tert-butylamino.

Di(C_1-C_4alkyl)amino also means that the two radicals are independently of the other branched or unbranched, such as dimethylamino, methylethylamino, diethylamino, methyl-n-propylamino, methylisopropylamino, methyl-n-butylamino, methylisobutylamino, ethylisopropylamino, ethyl-n-butylamino, ethylisobutylamino, ethyl-tert-butylamino, diethylamino, diisopropylamino, isopropyl-n-butylamino, isopropylisobutylamino, di-n-butylamino or di-isobutylamino.

Alkanoylamino of up to 25 carbon atoms is a branched or unbranched radical, such as formylamino, acetylamino, propionylamino, butanoylamino, pentanoylamino, hexanoylamino, heptanoylamino, octanoylamino, nonanoylamino, decanoylamino, undecanoylamino, dodecanoylamino, tridecanoylamino, tetradecanoylamino, pentadecanoylamino, hexadecanoylamino, heptadecanoylamino, octadecanoyamino, eicosanoylamino or docsanoylamino. Alkanoylamino of 2 to 18, in particular of 2 to 12, e.g. of 2 to 6, carbon atoms is preferred.

C_1-C_{18}Alkylene is a branched or unbranched radical, such as methylene, ethylene, propylene, trimethylene, tetramethylene, pentamethylene, hexamethylene, heptamethylene, octamethylene, decamethylene, dodecamethylene or octadecamethylene. C_1-C_{12}Alkylene and, in particular, C_1-C_8alkylene are preferred.

A C_1-C_4Alkyl-substituted C_5-C_{12}cycloalkylene ring which preferably contains 1 to 3, in particular 1 or 2, branched or unbranched alkyl groups is typically cyclopentylene, methylcyclopentylene, dimethylcyclopentylene, cyclohexylene, methylcyclohexylene, dimethylcyclohexylene, trimethylcyclohexylene, tert-butylcyclohexylene, cycloheptylene, cyclooctylene or cyclodecylene. Cyclohexylene and tert-butylcyclohexylene are preferred.

C_2-C_{18}Alkylene which is interrupted by oxygen, sulfur or  is, for example,

$-CH_2-O-CH_2-$, $-CH_2-S-CH_2-$, $-CH_2-NH-CH_2-$, $-CH_2-N(CH_3)-CH_2-$, $-CH_2-O-CH_2CH_2-O-CH_2-$, $-CH_2-(O-CH_2CH_2-)_2O-CH_2-$, $-CH_2-(O-CH_2CH_2-)_3O-CH_2-$, $-CH_2-(O-CH_2CH_2-)_4O-CH_2-$ or $-CH_2CH_2-S-CH_2CH_2-$.

C_2-C_{18}Alkenylene is typically vinylene, methylvinylene, octenylethylene or dodecenylethylene. C_2-C_8Alkenylene is preferred.

Alkylidene of 2 to 20 carbon atoms is, for example, ethylidene, propylidene, butylidene, pentylidene, 4-methylpentylidene, heptylidene, nonylidene, tridecylidene, nonadecylidene, 1-methylethylidene, 1-ethylpropylidene or 1-ethylpentylidene. C_2-C_8Alkylidene is preferred.

Phenylalkylidene of 7 to 20 carbon atoms is typically benzylidene, 2-phenylethylidene or 1-phenyl-2-hexylidene. C_7-C_9Phenylalkylidene is preferred.

C_5-C_8Cycloalkylene is a saturated hydrocarbon group having two free valencies and at least one ring unit and is typically cyclopentylene, cyclohexylene, cycloheptylene or cyclooctylene. Cyclohexylene is preferred.

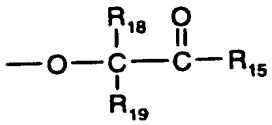
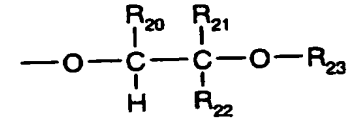
C_7-C_8Bicycloalkylene is typically bicycloheptylene or bicyclooctylene.

Unsubstituted or C_1-C_4alkyl-substituted phenylene or naphthylene is typically 1,2-, 1,3-, 1,4-phenylene, 1,2-, 1,3-, 1,4-, 1,6-, 1,7-, 2,6- or 2,7-naphthylene. 1,4-Phenylene is preferred.

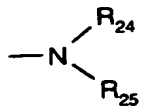
A C_1-C_4alkyl-substituted C_5-C_8cycloalkylidene ring which preferably contains 1 to 3, in particular 1 or 2, branched or unbranched alkyl groups is typically cyclopentylidene, methylcyclo-

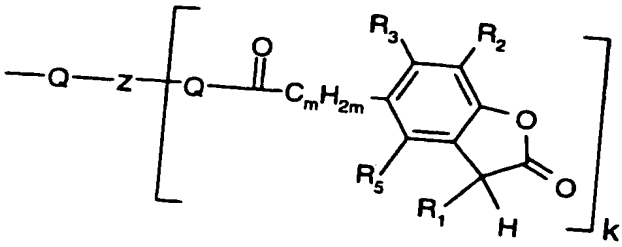
pentylidene, dimethylcyclopentylidene, cyclohexylidene, methylcyclohexylidene, dimethylcyclohexylidene, trimethylcyclohexylidene, tert-butylcyclohexylidene, cycloheptylidene or cyclooctylidene. Cyclohexylidene and tert-butylcyclohexylidene are preferred.

A mono-, di- or tri-valent metal cation is preferably an alkali metal cation, alkaline earth metal cation or aluminium cation, typically Na^+, K^+, Mg^{++}, Ca^{++} or Al^{+++}.

Preferred are compositions containing a compound of formula I, wherein
R_2, R_3 and R_5 , independently, are H, Cl, hydroxy, C_1-C_{25}alkyl, C_7-C_9phenylalkyl, unsubstituted or C_1-C_4alkyl-substituted phenyl; C_1-C_{18}alkoxy, C_1-C_{25}alkanoyloxy, C_3-C_{25}alkenoyloxy; and where
R_4 is Cl, hydroxy, C_1-C_{25}alkyl, C_7-C_9phenylalkyl, unsubstituted or C_1-C_4alkyl-substituted phenyl; C_1-C_{18}alkoxy, C_1-C_{25}alkanoyloxy, C_3-C_{25}alkenoyloxy or is a group $-C_mH_{2m}-COR_{15}$, or where R_3, R_5 and R_6 are H, R_4 may be a residue of formula III, or where R_8 or R_{10} are other than H, R_4 may also be hydrogen;
R_6 is H,
R_7, R_8, R_9, R_{10} and R_{11} independently are H, halogen, hydroxy, C_1-C_{25}alkyl, O interrupted C_2-C_{25}alkyl; C_1-C_{25}alkoxy, O interrupted C_2-C_{25}alkoxy, C_3-C_{25}alkenyl, C_3-C_{25}alkenyloxy, C_7-C_9phenylalkyl, C_7-C_9phenylalkoxy, unsubstituted or C_1-C_4alkyl-substituted phenyl; unsubstituted or C_1-C_4alkyl substituted phenoxy; unsubstituted or C_1-C_4alkyl substituted C_5-C_8cycloalkyl; unsubstituted or C_1-C_4alkyl substituted C_5-C_8cycloalkoxy; C_1-C_4alkylamino, di-(C_1-C_4-alkyl)amino, C_1-C_{25}alkanoyl; C_1-C_{25}alkanoyloxy; C_6-C_9cycloalkylcarbonyl, C_6-C_9cycloalkylcarbonyloxy, benzoyl or C_1-C_{12}alkyl-substituted benzoyl; benzoyloxy or C_1-C_{12}alkyl substituted benzoyloxy;  or  , or

where in formula II R_7 and R_8 or R_8 and R_{11} together with the carbon atoms, they are bonded to, form a phenyl ring;

R_{15} is C_1-C_{18}alkoxy or  or a group of formula IIIa;



(IIIa);

R_{16} and R_{17} independently are H, CF_3, C_1-C_{12}alkyl or phenyl; or R_{16} and R_{17} together with the bonding carbon atom form an unsubstituted or 1-3 C_1-C_4alkyl-substituted C_5-C_8cycloalkylidene ring;

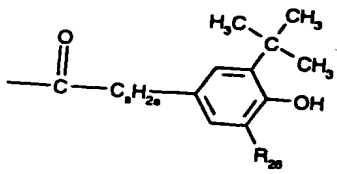
R_{18} andR_{19} independently are H, C_1-C_4alkyl or phenyl;

R_{20} is H or C_1-C_4alkyl;

R_{21} is H, unsubstituted or C_1-C_4alkyl substituted phenyl; C_1-C_{25}alkyl, unsubstituted or on the phenyl ring 1-3 C_1-C_4alkyl-substituted C_7-C_9phenylalkyl;

R_{22} is H or C_1-C_4alkyl;

R_{23} is H, C_1-C_{25}alkanoyl, C_3-C_{25}alkenoyl; di(C_1-C_6alkyl)phosphonate-substituted C_2-C_{25}alkanoyl; C_6-C_9cycloalkylcarbonyl, thenoyl, furoyl, benzoyl or C_1-C_{12}alkyl-substituted benzoyl;



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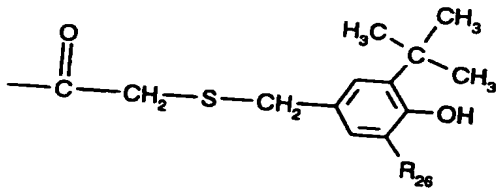

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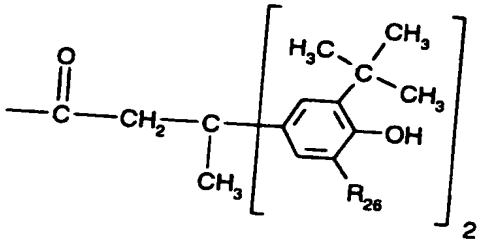

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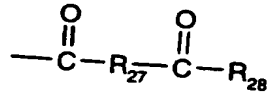

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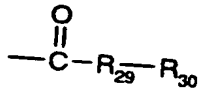

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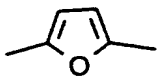
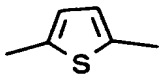
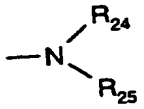
R_{24} and R_{25} independently are H or C_1-C_{18}alkyl;

R_{26} is H or C_1-C_8alkyl;

R_{27} is a direct bond, C_1-C_{18}alkylen, C_2-C_{18}alkenylen, C_7-C_{20}phenylalkyliden, C_5-C_8cycloalkylen, unsubstituted or C_1-C_4alkyl-substituted phenylene,  or  ;

R_{28} C_1-C_{18}alkoxy or  ;

R_{29} is O or -NH-;

R_{30} C_1-C_{18}alkyl or phenyl:

M a metal cation of the valency r;

X a direct bond, O, S or $-NR_{31}-$;

n 1 or 2;

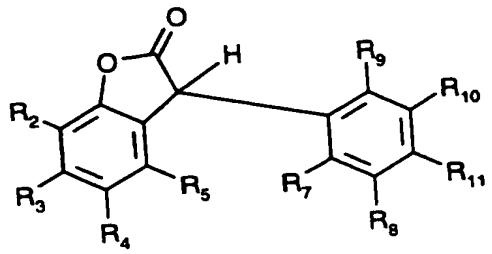
m is a number from the range 1-8;

q 1, 2, 3, 4, 5 or 6;

r 1, 2 or 3; and

s is 0, 1 or 2.

More preferred for use according to present invention is a compound of the formula IV



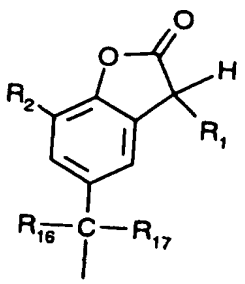
(IV)

wherein

R_2 is H or C_1-C_{20}alkyl;

R_3 is H or C_1-C_{18}alkyl;

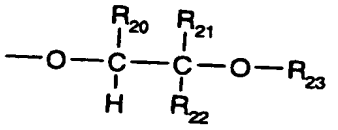
R_4 is C_1-C_8alkyl, H, C_1-C_6alkoxy or a group $-C_mH_{2m}-COR_{15}$ or a group of the formula III



(III);

R_5 is H or C_1-C_{18}alkyl;

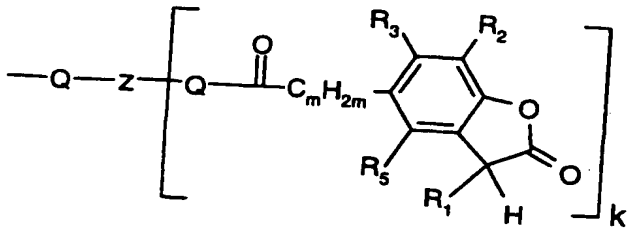
R_7, R_8, R_9, R_{10} and R_{11} independently are H, OH, chloro, C_1-C_{18}alkyl, C_1-C_{18}alkoxy, di(C_1-C_4alkyl)amino, phenyl, C_2-C_{18}alkanoyloxy, C_3-C_{18}-alkoxycarbonylalkoxy or



;

especially wherein at least 2 of the residues R_7, R_8, R_9, R_{10}, R_{11} are H;

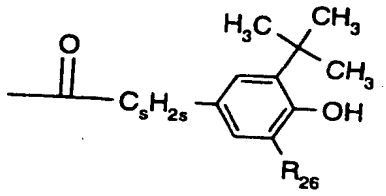
R_{15} is C_1-C_{18}alkoxy or a group of the formula IIIa



(IIIa);

R_{16} and R_{17} independently are H, C_1-C_{12}alkyl or phenyl; or R_{16} and R_{17} together with the bonding carbon atom form a C_5-C_8cycloalkylidene ring;

R_{20}, R_{21} and R_{22} independently are H or C_1-C_4alkyl;

R_{23} is H, C_2-C_{18}alkanoyl or a group 

R_{26} is C_1-C_4alkyl;

Q is oxygen;

Z is C_2-C_{12}alkylene;

k is 1;

m is 1, 2, 3, 4, 5 or 6 and

s is 0, 1 or 2.

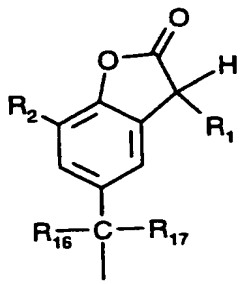
R_4 is preferably not H, most preferably not H and not OH. Especially preferred is a compound wherein R_4 is C_1-C_6alkyl, especially tertiary C_4-C_6alkyl, or a group $-C_mH_{2m}-COR_{15}$ or a group of the formula III.

Most preferred for use according to present invention is a compound of the formula IV wherein

R_2 is C_1-C_{20}alkyl;

R_3 is H or C_1-C_{18}alkyl;

R_4 is C_1-C_6alkyl, C_1-C_6alkoxy or a group $-C_mH_{2m}-COR_{15}$ or a group of the formula III

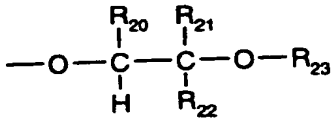


(III);

R_5 is H or C_1-C_{18}alkyl;

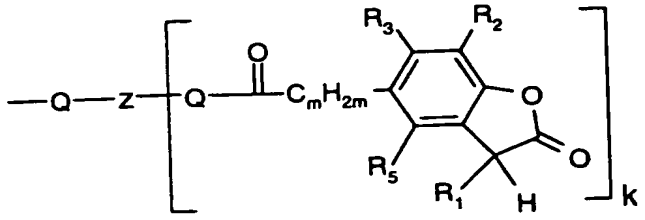
R_7 and R_9 independently are H, chloro, C_1-C_{18}alkyl;

R_8, R_{10} and R_{11} independently are H, OH, chloro, C_1-C_{18}alkyl, C_1-C_{18}alkoxy, di(C_1-C_4alkyl)amino, phenyl, C_2-C_{18}alkanoyloxy or



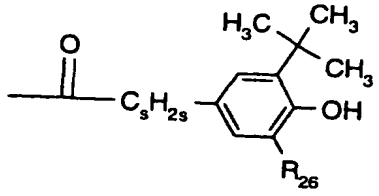
;

R_{15} is C_1-C_{18}alkoxy or a group of the formula IIIa



(IIIa);

R_{20}, R_{21} and R_{22} are H;

R_{23} is H, C_2-C_{18}alkanoyl or a group 

R_{26} is C_1-C_4alkyl;

Q is oxygen;

Z is C_2-C_{12}alkylene;

k is 1;

m is 1, 2, 3, 4, 5 or 6 and

s is 0, 1 or 2.

Of special interest are those compounds of formula IV wherein R_7 is H and R_9 is H or methyl.

More interesting is a process where in the compound of formula I, if n = 1, R_1 is phenyl which is unsubstituted or substituted in para-position by C_1-C_{18}alkylthio or di(C_1-C_4-alkyl)amino; mono- to penta-substituted alkylphenyl containing together a total of at most 18 carbon atoms in the 1 to 5 alkyl substituents; naphthyl, biphenyl, terphenyl, phenanthryl, anthryl, fluorenyl, carbazolyl, thienyl, pyrrolyl, phenothiazinyl or 5,6,7,8-tetrahydronaphthyl which are unsubstituted or substituted by C_1-C_4-alkyl, C_1-C_4alkoxy, C_1-C_4alkylthio, hydroxy or amino.

Also preferred compositions contain compounds of the formula I wherein the bonding atom in R_2 is a secondary or tertiary carbon atom, especially wherein R_2 is secondary C_6-C_{22} alkyl or tertiary C_4-C_{22}alkyl or phenyl or substituted phenyl or alkyl or alkoxy interrupted by COO; R_4 is secondary C_6-C_{22} alkyl or tertiary C_4-C_{22}alkyl or a group of formula III or alkyl or alkoxy interrupted by COO; and R_{11} is H or methyl or phenyl or alkyl or alkoxy interrupted by COO. Of special interest are compounds whose residues R_2, R_4 or R_{11} contain an ester group.

Especially preferred are compounds of the formula IV wherein

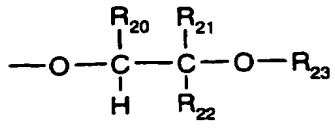
R_2 is H or C_1-C_{20}alkyl;

R_3 is H or C_1-C_{18}alkyl;

R_4 is C_1-C_6alkyl, $-(CH_2)_p-COR_{15}$ or $-C(CH_3)_2-(CH_2)_p-COR_{15}$;

R_5 is H or C_1-C_{18}alkyl;

R_7, R_8, R_9, R_{10} and R_{11} independently are H, C_1-C_{18}alkyl, C_1-C_{18}alkoxy or



;

especially wherein at least 2 of the residues R_7, R_8, R_9, R_{10}, R_{11} are H;

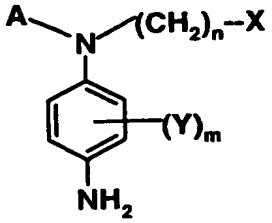
R_{15} is C_1-C_{18}alkoxy;

R_{20}, R_{21} and R_{22} are H; and

p is 2 or 3.

Compounds of the formula I or IV can be obtained according to methods known in the art, e.g. as described in GB-A-2281910 or publications cited therein, or, like compounds of formula V, in analogy to those methods. Some compounds of the formula I are commercially available.

This class of lactones are preferably used to trap the oxidised form of a developer having the following general structure:



where A = C_1-C_6-Alkyl;

n = 1 - 6;

X = Hydrogen, Hydroxy, C_1-C_8-Alkoxy , COR_{15}, $NHSO_2R_{30}$;

Y = C_1-C_8alkyl, C_1-C_8alkoxy, halogen; m = 0 - 4.

In the above structure the preferred substituents are A = $-CH_2CH_3$ and n=2, X = hydrogen or $-NHSO_2CH_3$ or -OH or $-OCH_3$, Y = hydrogen or $-CH_3$ and m = 1.

The photographic materials according to this invention comprise a support bearing at least one layer of a light-sensitive silver halide emulsion.

Examples of colour photographic materials according to this invention are colour negative films, colour reversal films, colour positive films, colour photographic paper, colour reversal

photographic paper, colour-sensitive materials for the dye diffusion transfer process or the silver dye bleach process.

Of especial interest is a colour photographic recording material comprising, on a base, at least one blue-sensitive silver halide emulsion layer containing at least one yellow dye providing compound, at least one green-sensitive silver halide emulsion layer containing at least one magenta dye providing compound, at least one red-sensitive silver halide emulsion layer containing at least one cyan dye providing compound, and customary (non light sensitive) top layer(s) and interlayers separating the light-sensitive layers.
The layers of the colour photographic material can be arranged in various orders as is well known in the art.

The compound of the formula I or IV can be contained in any of the layers of the photographic material, i.e. in any of the light sensitive silver halide emulsion layers or in a non light sensitive layer. For use as a Dox scavenger, the compound of the formula I is preferably contained in one or more non light sensitive layers. In this case, the light sensitive layers may contain a lower concentration of the compound of the formula I or none.

In general, the compounds of the formula I or IV are contained in the photographic material in an amount from 10 to 1000 mg/m^2, especially from 30 to 500 mg/m^2.

The lactones of formula I or IV can be milled with polymers (e.g. PVS, polyester, polyvinyl alcohol etc.) and placed in a layer thus preventing its migration to adjacent layers. Also, the benzofuranones containing a suitable functional group (e.g. ester, hydroxy) can be reacted with a polymer, e.g. a polyvinyl alcohol or polyester, in order to attach them chemically. This form will reduce their migrating tendency.

Typical bases for the photographic material include polymeric films and paper (including polymer-coated paper). Details regarding supports and other layers of colour photographic recording materials can be found in Research Disclosure, Item 36544, September 1994.

Essential constituents of the photographic emulsion layers are binders, silver halide particles and colour couplers. Details regarding the constituents of the light sensitive layers and other

(non light sensitive) layers such as top layers and interlayers separating the silver halide emulsion layers can be found in Research Disclosure, Item 38957, September 1996.

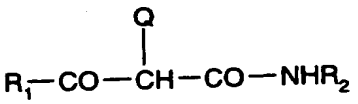
The invention therefore also pertains to a colour photographic material comprising a compound of the formula I or IV, and to the use of a compound of the formula I or IV as an additive in a colour photographic material.

Preferred compounds of the formula I or IV in the colour photographic material of the invention or the corresponding use are as described for the process of the invention.

Compounds of present invention are with special advantage when incorporated into photographic materials containing magenta couplers of the pyrazolotriazole class.

Examples for especially suitable yellow, magenta and cyan couplers to be used in combination with compounds of the present invention are given below:

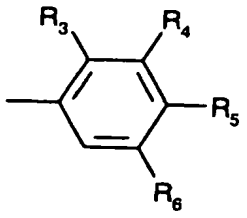
Yellow couplers which can be used in the novel material are preferably compounds of the formula A



(A),

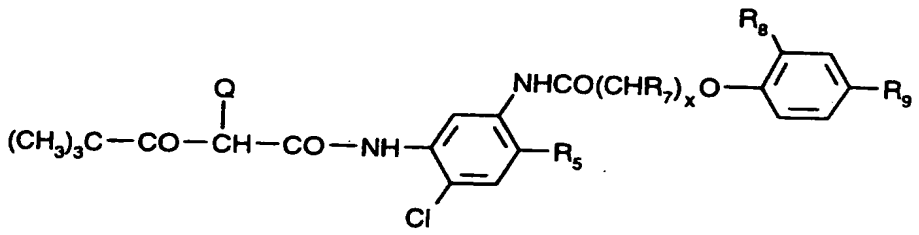
in which R_1 is alkyl or aryl, R_2 is aryl and Q is hydrogen or a group which can be eliminated by reaction with the oxidized developer.

One group of yellow couplers comprises those compounds of the formula A in which R_1 is t-butyl and R_2 is a group of the formula



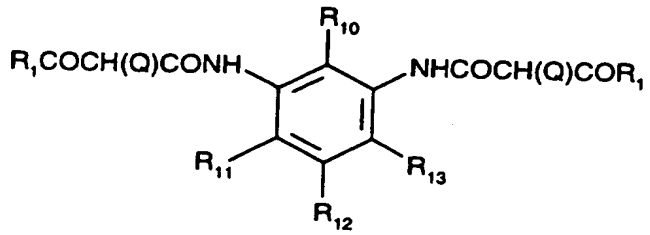
in which R_3 is hydrogen, halogen, alkyl or alkoxy and R_4, R_5 and R_6 are hydrogen, halogen, alkyl, alkenyl, alkoxy, aryl, carboxyl, alkoxycarbonyl, a carbamoyl group, a sulfonyl or sulfamoyl group, an alkylsulfonamino group, acylamino group, ureido group or amino group.

Preferably, R_3 is chlorine, R_4 and R_5 are hydrogen and R_6 is an acylamino group. This also includes the compounds of the formula



in which x is 0-4, R_7 is hydrogen or alkyl and R_8 and R_9 are alkyl.

Another group of yellow couplers conforms to the formula B



(B),

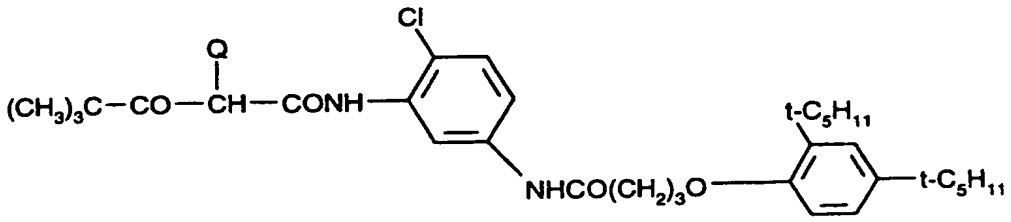
in which R_{10} is hydrogen, halogen or alkoxy,
R_{11}, R_{12} and R_{13} are hydrogen, halogen, alkyl, alkenyl, alkoxy, aryl, carboxyl, alkoxycarbonyl, a carbamoyl group, a sulfonyl group, a sulfamoyl group, sulfonamido group, acylamino group, ureido group or amino group and R_1 and Q are as defined above.

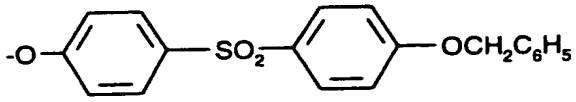
This group includes compounds of the formula B in which R_1 is t-butyl, R_{10} is chlorine, R_{11} and R_{13} are hydrogen and R_{12} is alkoxycarbonyl.

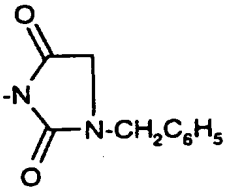
In the compounds of the formulae A and B the leaving group Q can be hydrogen or is a heterocyclic group

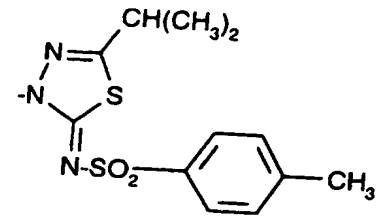
in which R_{14} is a divalent organic group which supplements the ring to make up a 4-7-membered ring, or Q is a group $-OR_{15}$ in which R_{15} is alkyl, aryl, acyl or a heterocyclic radical.

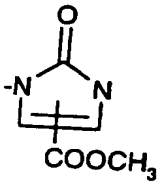
Typical examples of customary yellow couplers are the compounds of the following formulae:

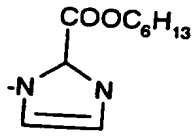


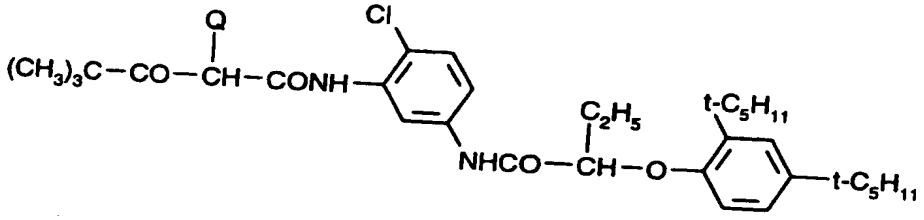
a) Q = 

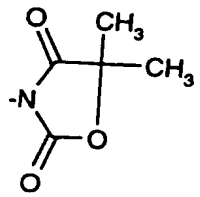
b) Q = 

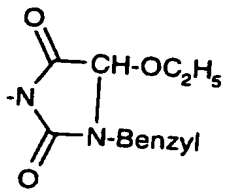
c) Q = 

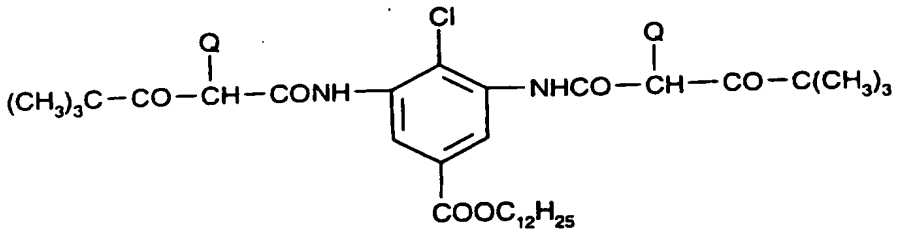
d) Q = 

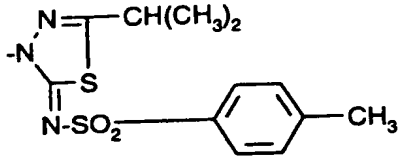
e) Q = 



f) Q = 

g) Q = 

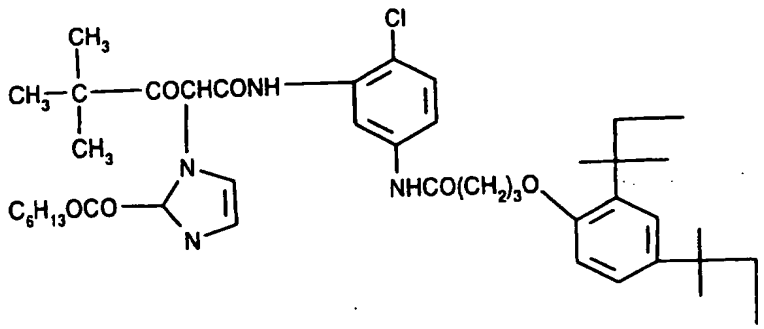


h) Q = 

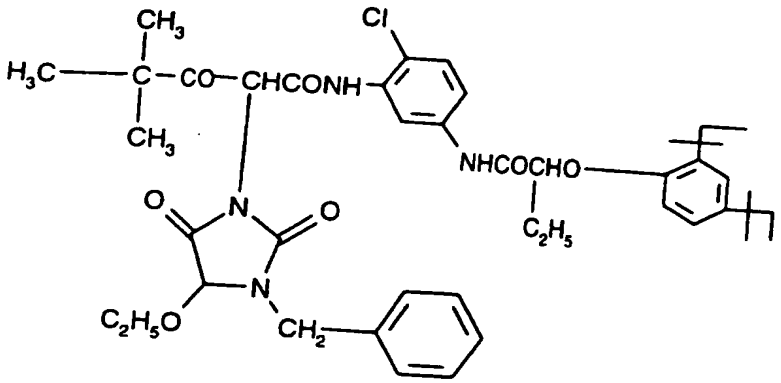
Further examples of yellow couplers are given in US-A 2,407,210, 2,778,658, 2,875,057, 2,908,513, 2,908,573, 3,227,155, 3,227,550, 3,253,924, 3,265,506, 3,277,155, 3,408,194, 3,341,331, 3,369,895, 3,384,657, 3,415,652, 3,447,928, 3,551,155, 3,582,322, 3,725,072, 3,891,445, 3,933,501, 4,115,121, 4,401,752 and 4,022,620, in DE-A 1,547,868, 2,057,941, 2,162,899, 2,163,813, 2,213,461, 2,219,917, 2,261,361, 2,261,362, 2,263,875, 2,329,587, 2,414,006 and 2,422,812, in GB-A 1,425,020 and 1,077,874 and in JP-A-88/123,047 and in EP-A-447,969.

The yellow couplers are customarily used in an amount of 0.05-2 mol and preferably 0.1-1 mol per mole of silver halide.

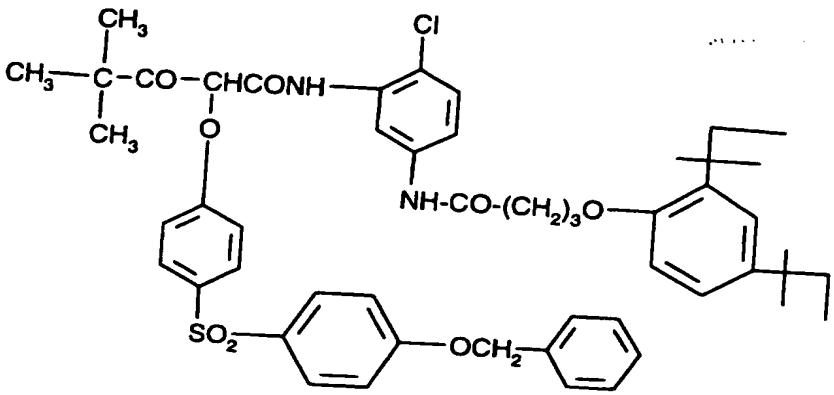
Typical and preferred yellow couplers conform to the formulae:

(Y-1) 

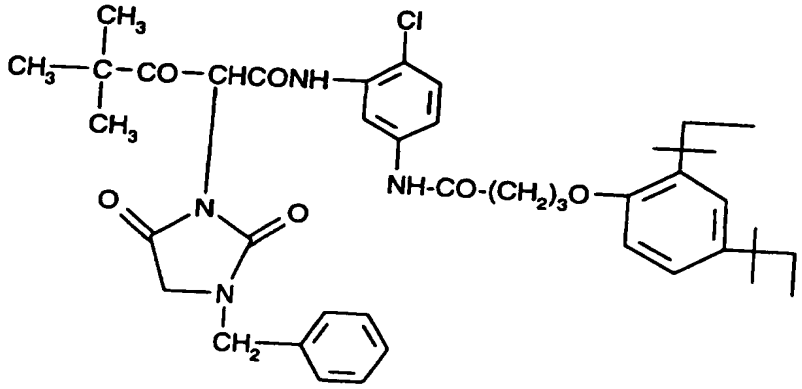
(Y-2)



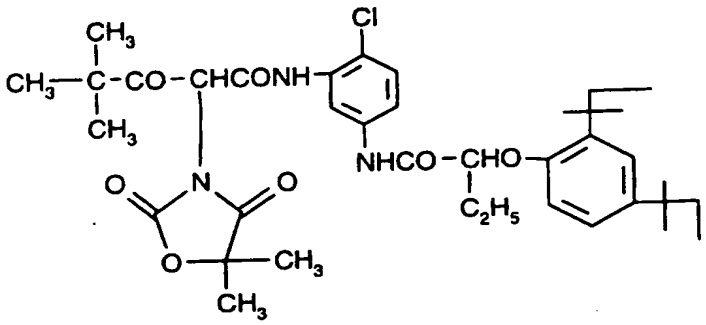
(Y-3)

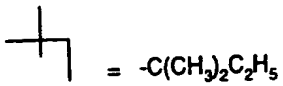


(Y-4)

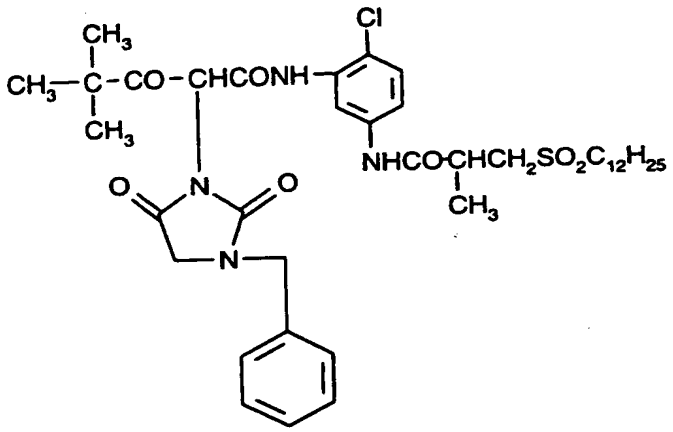


(Y-5)

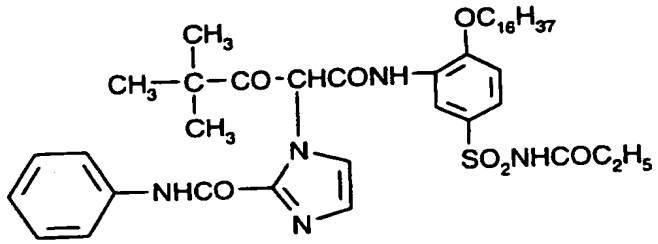




(Y-6)



(Y-7)



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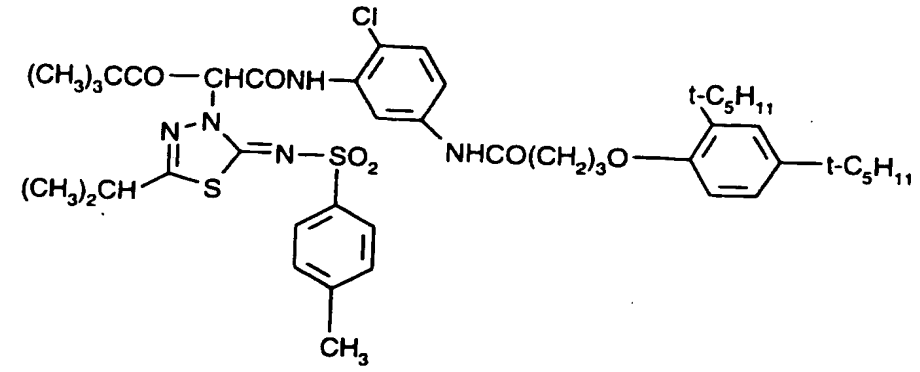

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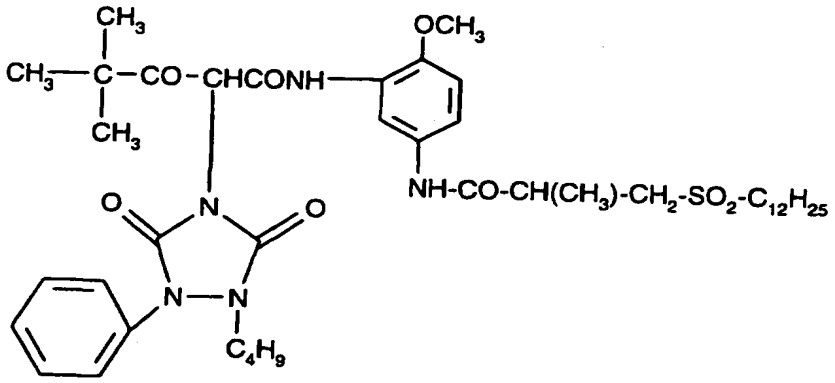
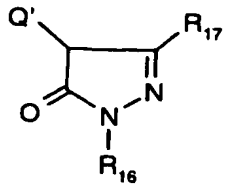


Magenta couplers may, for example, be simple 1-aryl-5-pyrazolones or may be pyrazole derivatives which are fused with 5-membered heterocyclic rings, examples being imidazo-pyrazoles, pyrazolopyrazoles, pyrazolotriazoles or pyrazolotetrazoles.

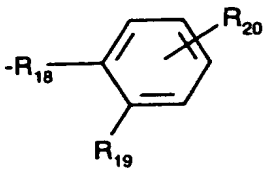
One group of magenta couplers comprises 5-pyrazolones of the formula C



(C),

as are described in British Patent 2,003,473. In this formula, R_{16} is hydrogen, alkyl, aryl,

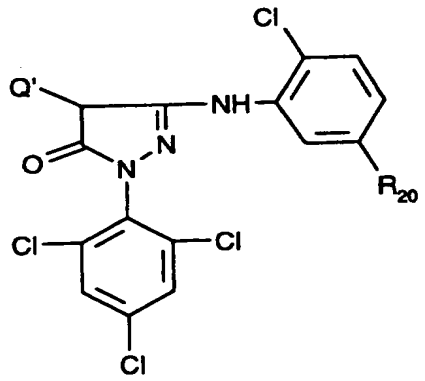
alkenyl or a heterocyclic group, R_{17} is hydrogen, alkyl, aryl, a heterocyclic group, an ester group, alkoxy group, alkylthio group, carboxyl group, arylamino group, acylamino group, (thio)urea group, (thio)carbamoyl group, guanidino group or sulfonamido group.

R_{17} is preferably a group 

in which R_{18} is imino, acylamino or ureido, R_{19} is hydrogen, halogen, alkyl or alkoxy, R_{20} is hydrogen, alkyl, acylamino, carbamoyl, sulfamoyl, sulfonamido, alkoxycarbonyl, acyloxy or a urethane group.

If Q' is hydrogen, then the magenta coupler is tetraequivalent in relation to the silver halide.

Typical examples of this type of magenta coupler are compounds of the formula



in which R_{20} is as defined above and Q', as described above, is a leaving group. These compounds are preferably present in the material of this novel process.

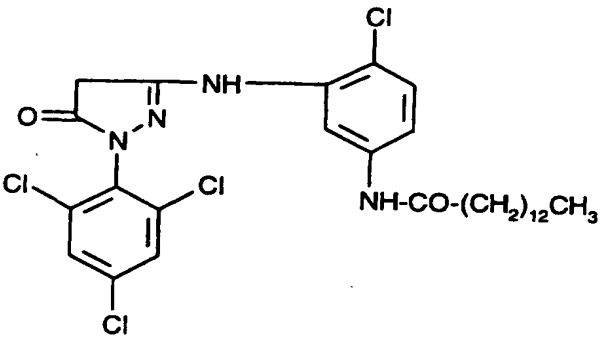
Further examples of such tetraequivalent magenta couplers are given in US-A 2,983,608, 3,061,432, 3,062,653, 3,127,269, 3,152,896, 3,311,476, 3,419,391, 3,519,429, 3,558,319, 3,582,322, 3,615,506, 3,684,514, 3,834,908, 3,888,680, 3,891,445, 3,907,571, 3,928,044, 3,930,861, 3,930,866 and 3,933,500 and in JP-A-89/309,058.

If Q' in formula C is not hydrogen but a group which is eliminated in reaction with the oxidized developer, then the magenta coupler is diequivalent. In this case Q may for example be halogen or a group which is attached via O, S or N to the pyrazole ring. Diequivalent couplers of this kind give rise to a higher colour density and are more reactive with respect to the oxidized developer than are the corresponding tetraequivalent magenta couplers.

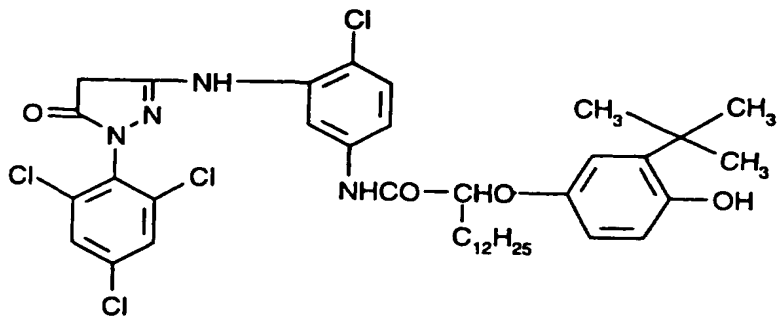
Examples of diequivalent magenta couplers are described in US-A 3,006,579, 3,419,391, 3,311,476, 3,432,521, 3,214,437, 4,032,346, 3,701,783, 4,351,897, 3,227,554, in EP-A-133,503, DE-A-2,944,601, JP-A-78/34044, 74/53435, 74/53436, 75/53372 and 75/122935.

Typical and preferred magenta couplers conform to the formulae

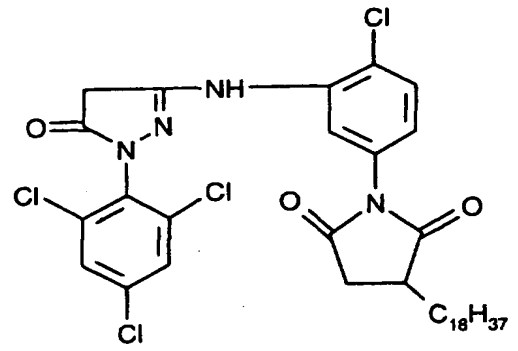
(M-1)



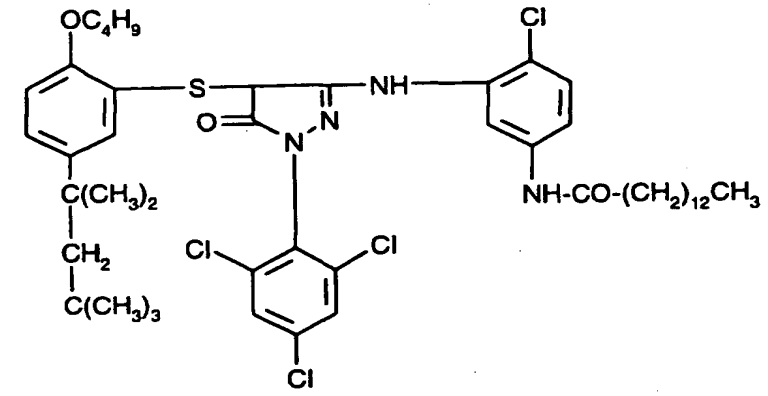
(M-2)



(M-3)



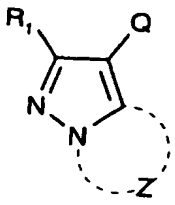
(M-4)



It is possible for 2 pyrazolone rings to be linked via a divalent Q', giving so-called bis-couplers. These are described, for example, in US-A-2,632,702, US-A-2,618,864, GB-A-968,461, GB-A-786,859, JP-A-76/37646, 59/4086, 69/16110, 69/26589, 74/37854 and 74/29638. Y is preferably an O-alkoxyarylthio group.

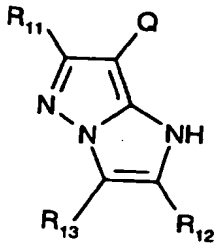
As mentioned above, the magenta couplers used can also be pyrazoles fused with 5-membered heterocycles, and are then known as pyrazoloazoles. Their advantages over simple pyrazoles are that they possess colours of greater formalin resistance and have purer absorption spectra.

Magenta couplers of the pyrazoloazole type which are likewise preferred may be represented by the formula

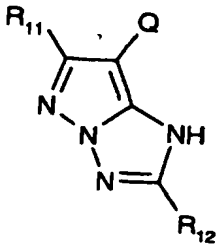


in which R_1 is hydrogen or a substituent, Z represents the non-metallic atoms necessary to complete a 5-membered ring containing 2 or 3 nitrogen atoms, which ring may be substituted, and Q is hydrogen or a leaving group.

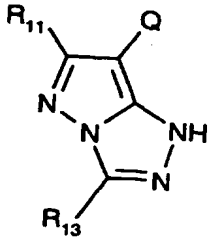
Of these compounds, preference is given to magenta couplers of the formulae



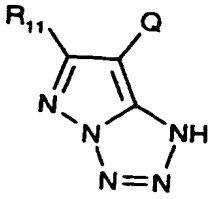
(M-a)



(M-b)



(M-c)



(M-d)

R_{11}, R_{12} and R_{13} independently of one another are, for example, hydrogen, halogen, a group of the formula $-CR_3$ in which the radicals R, independently of one another, are hydrogen or alkyl, or aryl, heterocyclyl, cyano, hydroxyl, nitro, carboxyl, amino, alkoxy, aryloxy, acylamino, alkylamino, anilino, ureido, sulfamoylamino, alkylthio, arylthio, alkoxycarbonylamino, sulfonamido, carbamoyl, sulfamoyl, sulfonyl, alkoxycarbonyl, heterocyclyloxy, azo, acyloxy, carbamoyloxy, silyloxy, aryloxycarbonylamino, imido, heterocyclic ring-thio, sulfinyl, phosphonyl, aryloxycarbonyl, acyl or azolyl, and preferably hydrogen; halogen (e.g. chlorine, bromine), a group of the formula $-CR_3$ in which the radicals R independently of one another are hydrogen or alkyl, or aralkyl, alkenyl, alkynyl, cycloalkyl or cycloalkenyl, and particularly preferably methyl, ethyl, propyl, isopropyl, t-butyl, tridecyl, 2-methanesulfonylethyl, 3-(3-pentadecylphenoxy)propyl, 3-(4-(2-(4-(4-hydroxyphenylsulfonyl)phenoxy)dodecaneamido)phenyl)propyl, 2-ethoxytridecyl, trifluoromethyl, cyclopentyl, 3-(2,4-di-t-amylphenoxy)propyl); aryl (e.g. phenyl, 4-t-butylphenyl, 2,4-di-t-amylphenyl, 4-tetradecanamidophenyl); heterocyclyl (e.g.

2-furyl, 2-thienyl, 2-pyrimidinyl, 2-benzothiazolyl); cyano; hydroxyl, nitro; carboxyl; amino; alkoxy (e.g. methoxy, ethoxy, 2-methoxyethoxy; 2-dodecylethoxy, 2-methanesulfonylethoxy); aryloxy (e.g. phenoxy, 2-methylphenoxy, 4-t-butylphenoxy, 3-nitrophenoxy, 3-t-butyloxycarbamoylphenoxy, 3-methoxycarbamoyl); acylamino (e.g. acetamido, benzamido, tetradecaneamido, 2-(2,4-di-t-amylphenoxy)butaneamido, 4-(3-t-butyl-4-hydroxyphenoxy)butaneamido, 2-(4-(4-hydroxyphenylsulfonyl)phenoxy)decaneamido); methylbutylamino); anilino (e.g. phenylamino, 2-chloroanilino, 2-chloro-5-tetradecaneaminoanilino, 2-chloro-5-dodecyloxycarbonylanilino, N-acetylanilino, 2-chloro-5-(alpha-(3-t-butyl-4-hydroxyphenoxy)dodecaneamidoanilino); ureido (e.g. phenylureido, methylureido, N,N-dibutylureido); sulfamoylamino (e.g. N,N-dipropylsulfamoylamino, N-methyl-N-decylsulfamoylamino); alkylthio (e.g. methylthio, octylthio, tetradecylthio, 2-phenoxyethylthio, 3-phenoxypropylthio, 3-(4-t-butylphenoxy)propylthio); arylthio (e.g. phenylthio, 2-butoxy-5-t-octylphenylthio, 3-pentadecylphenylthio, 2-carboxyphenylthio, 4-tetradecaneamidophenylthio); alkoxycarbonylamino (e.g. methoxycarbonylamino, tetradecyloxycarbonylamino); sulfonamido (e.g. methanesulfonamido, hexadecanesulfonamido, benzenesulfonamido, p-toluenesulfonamido, octadecanesulfonamido, 2-methyloxy-5-t-butylbenzenesulfonamido); carbamoyl (e.g. N-ethylcarbamoyl, N,N-dibutylcarbamoyl, N-(2-dodecyloxyethyl)carbamoyl, N-methyl-N-dodecylcarbamoyl, N-(3-(2,4-di-t-amylphenoxy)propyl)carbamoyl); sulfamoyl (e.g. N-ethylsulfamoyl, N,N-dipropylsulfamoyl, N-2(-dodecyloxyethyl)sulfamoyl, N-ethyl-N-dodecylsulfamoyl, N,N-diethylsulfamoyl); sulfonyl (e.g. methanesulfonyl, octanesulfonyl, benzenesulfonyl, toluenesulfonyl); alkoxycarbonyl (e.g. methoxycarbonyl, butoxycarbonyl, dodecyloxycarbonyl, octadecyloxycarbonyl); heterocyclic ring-oxy (e.g. 1-phenyltetrazole-5-oxy, 2-tetrahydropyranyloxy); azo (e.g. phenylazo, 4-methoxyphenylazo, 4-pivaloylaminophenylazo, 2-hydroxy-4-propanoylphenylazo); acyloxy (e.g. acetoxy); carbamoyloxy (e.g. N-methylcarbamoyloxy, N-phenylcarbamoyloxy); silyloxy (e.g. trimethylsilyloxy, dibutylmethylsilyloxy); aryloxycarbonylamino (e.g. phenoxycarbonylamino); imido (e.g. N-succinimido, N-phthalimido, 3-octadecenylsuccinimido); heterocyclic ring-thio (e.g. 2-benzothiazolylthio, 2,4-diphenyloxy-1,3,5-triazole-6-thio, 2-pyridylthio); sulfinyl (e.g. dodecanesulfinyl, 3-pentadecylphenylsulfinyl, 3-phenoxypropylsulfinyl); phosphonyl (e.g. phenoxyphosphonyl, octyloxyphosphonyl, phenylphosphonyl); aryloxycarbonyl (e.g. phenoxycarbonyl); acyl (e.g. acetyl, 3-phenylpropanoyl, benzoyl, 4-dodecyloxybenzoyl); azolyl (e.g. imidazolyl, pyrazolyl, 3-chloropyrazol-1-yl).

These substituents may be substituted further, for example by halogen or by an organic radical attached via a C, O, N or S atom.

The preferred groups R_{11} are alkyl, aryl, alkoxy, aryloxy, alkylthio, ureido, urethane and acylamino groups.

R_{12} may be as defined for R_{11} and is preferably hydrogen, alkyl, aryl, a heterocyclic ring, alkoxycarbonyl, carbamoyl, sulfamoyl, sulfinyl, acyl or cyano.

R_{13} may be as defined for R_{11} and is preferably hydrogen, alkyl, aryl, heterocyclyl, alkoxy, aryloxy, alkylthio, arylthio, alkoxycarbonyl, carbamoyl or acyl, preferably alkyl, aryl, heterocyclyl, alkylthio or arylthio.

Q is hydrogen or a leaving group such as halogen, alkoxy, aryloxy, acyloxy, alkyl- or arylsulfonyloxy, acylamino, alkyl- or arylsulfonamido, alkoxycarbonyloxy, aryloxycarbonyloxy, alkyl-, aryl- or heterocyclyl-S-carbamoylamino, a 5- or 6-membered nitrogen-containing heterocyclic radical, imido and arylazo. These groups may be further substituted as indicated for R_{11}.

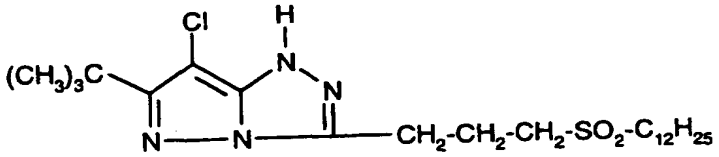
Q is preferably halogen (for example fluorine, chlorine, bromine); alkoxy (e.g. ethoxy, dodecyloxy, methoxyethylcarbamoylmethoxy, carboxypropyloxy, methylsulfonylethoxy, ethoxycarbonylmethoxy); aryloxy (e.g. 4-methylphenoxy, 4-chlorophenoxy, 4-methoxyphenoxy, 4-carboxyphenoxy, 3-ethoxycarboxyphenoxy, 3-acetylaminophenoxy, 2-carboxyphenoxy); acyloxy (e.g. acetoxy, tetradecanoyloxy, benzoyloxy); alkyl- or arylsulfonyloxy (e.g. methanesulfonyloxy, toluenesulfonyloxy); acylamino (e.g. dichloroacetylamino, heptafluorobutyrylamino); alkyl- or arylsulfonamido (e.g. methanesulfonamido, trifluoromethanesulfonamido, p-toluenesulfonylamido); alkoxycarbonyloxy (e.g. ethoxycarbonyloxy, benzyloxycarbonyloxy); aryloxycarbonyloxy (e.g. phenoxycarbonyloxy); alkyl, aryl- or heterocyclyl-S- (e.g. dodecylthio, 1-carboxydodecylthio, phenylthio, 2-butoxy-5-t-octylphenylthio, tetrazolylthio); carbamoylamino (e.g. N-methylcarbamoylamino, N-phenylcarbamoylamino); 5- or 6-membered nitrogen-containing ring (e.g. imidazolyl, pyrazolyl, triazolyl, tetrazolyl, 1,2-dihydro-2-oxo-1-pyridyl); imido (e.g. succinimido, hydantoinyl); arylazo (e.g. phenylazo, 4-methoxyphenylazo).

Q may alternatively form corresponding bis-compounds by condensation of 4 equivalents of coupler with an aldehyde or ketone. Furthermore, Q may contain photographically active groups, such as development inhibitors or development accelerators. Q is preferably halogen, alkoxy, aryloxy, alkyl- or arylthio, or a 5- or 6-membered nitrogen-containing heterocyclic group which is bonded to the coupling site via a nitrogen atom.

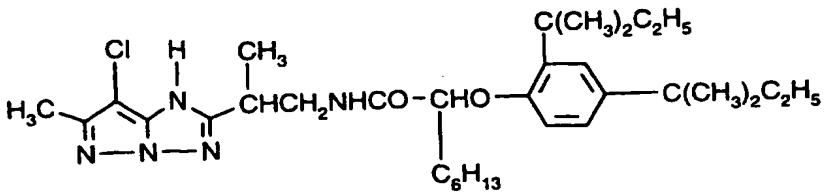
Pyrazolotetrazoles are described in JP-A-85/33552; pyrazolopyrazoles in JP-A-85/43,695; pyrazoloimidazoles in JP-A-85/35732, JP-A-86/18949 and US-A-4,500,630; pyrazolotriazoles in JP-A-85/186,567, JP-A-86/47957, JP-A-85/215,687, JP-A-85/197,688, JP-A-85/172,982, EP-A-119,860, EP-A-173,256, EP-A-178,789, EP-A-178,788 and in Research Disclosure 84/24,624.

Further pyrazoloazole magenta couplers are described in: JP-A-86/28,947, JP-A-85/140,241, JP-A-85/262,160, JP-A-85/213,937, JP-A-87/278,552, JP-A-87/279,340, JP-A-88/100,457, EP-A-177,765, EP-A-176,804, EP-A-170,164, EP-A-164,130, EP-A-178,794, DE-A-3,516,996, DE-A-3,508,766 and Research Disclosure 81/20919, 84/24531 and 85/25758.

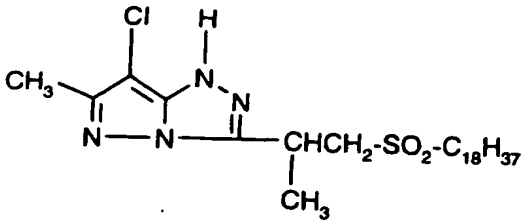
Suitable examples of such couplers are:



(M-5)



(M-6)



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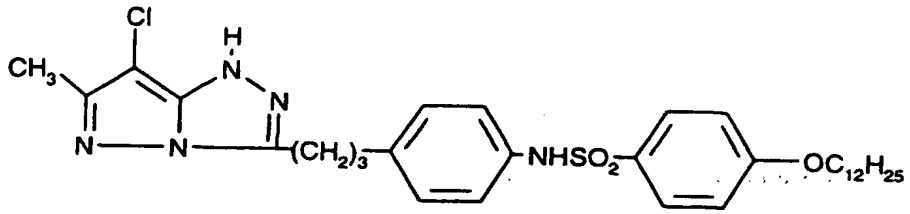

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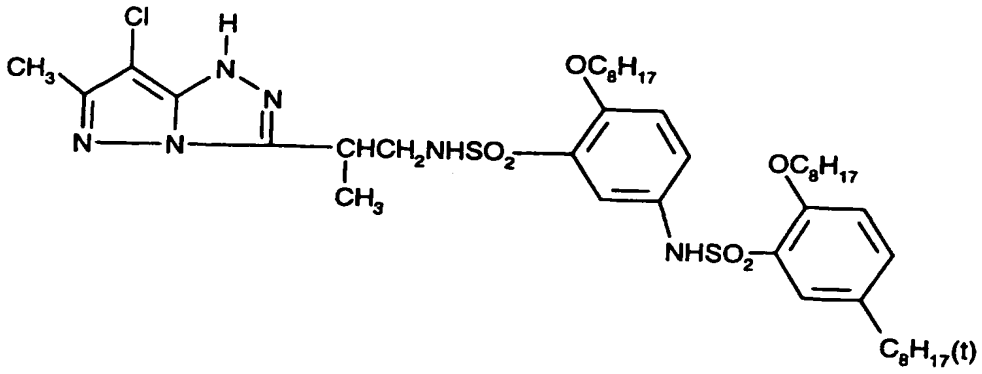

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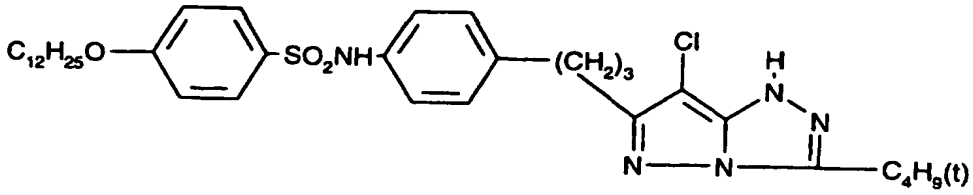
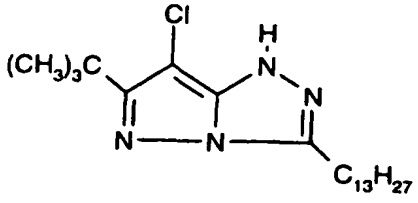
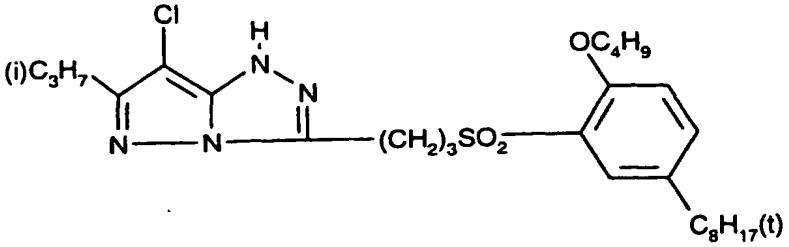


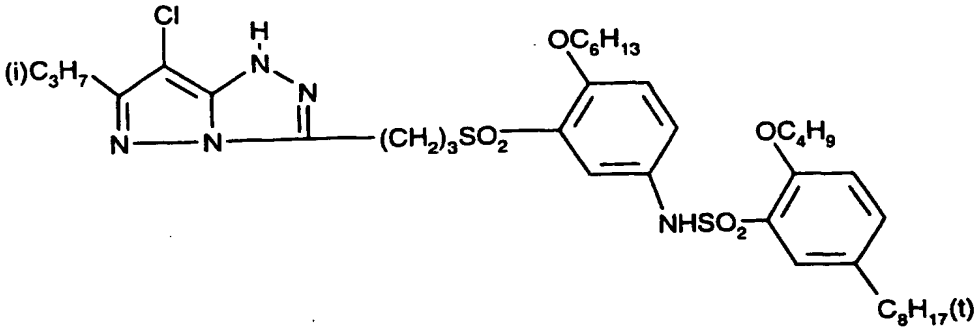
(M-10)



(M-11)



(M-12)



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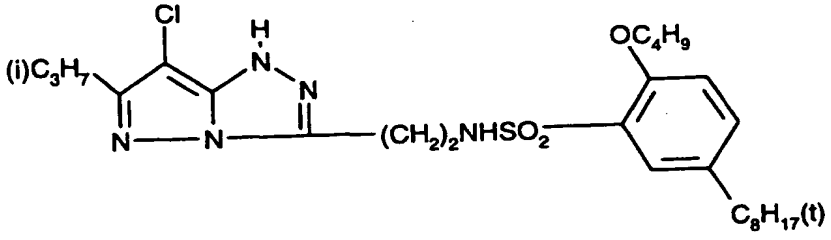

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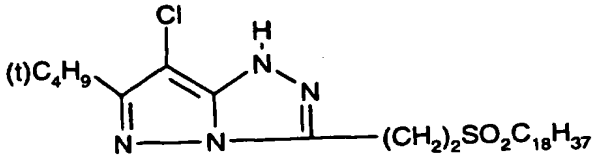

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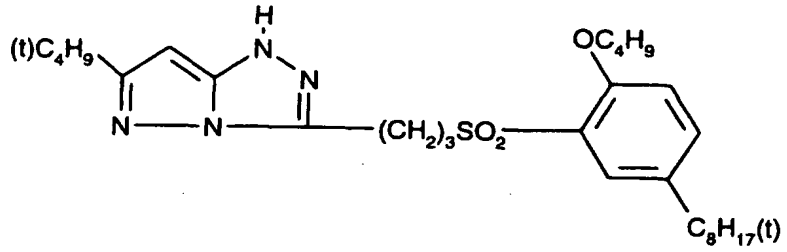

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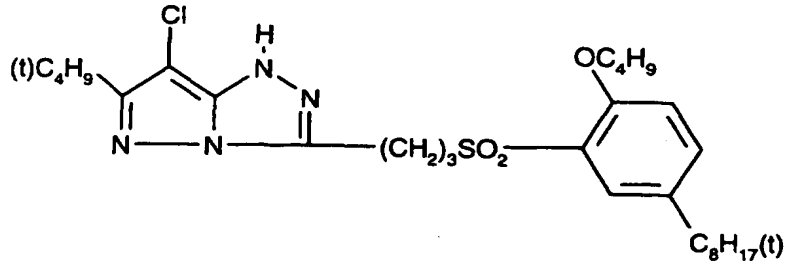
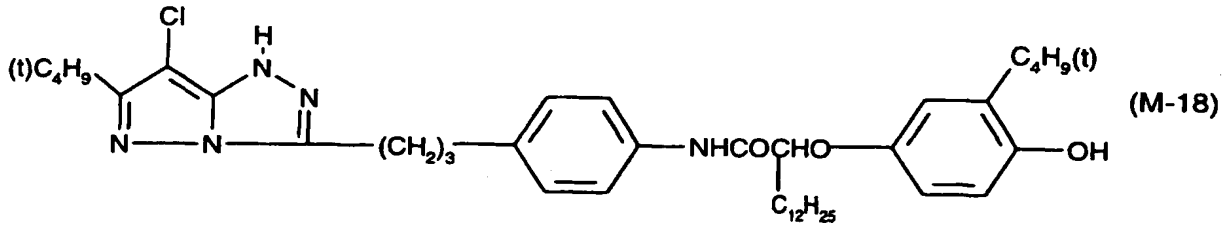


(M-17)



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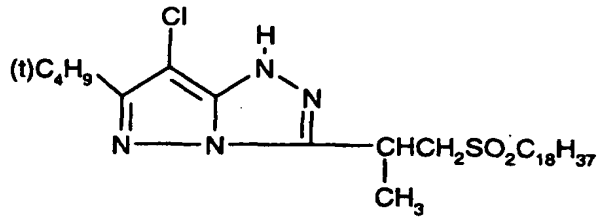

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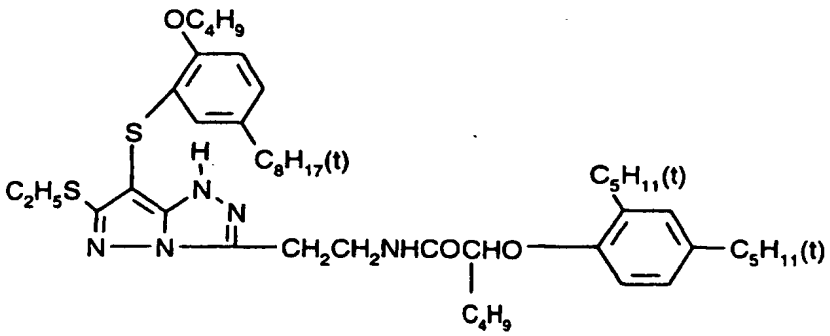

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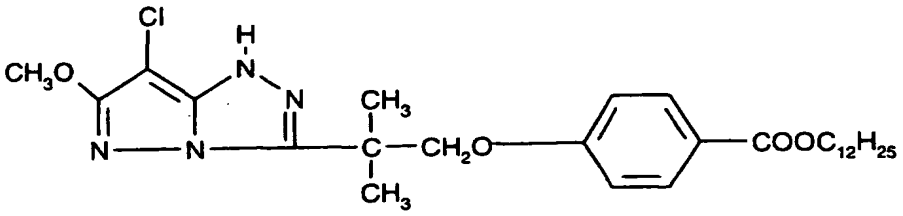

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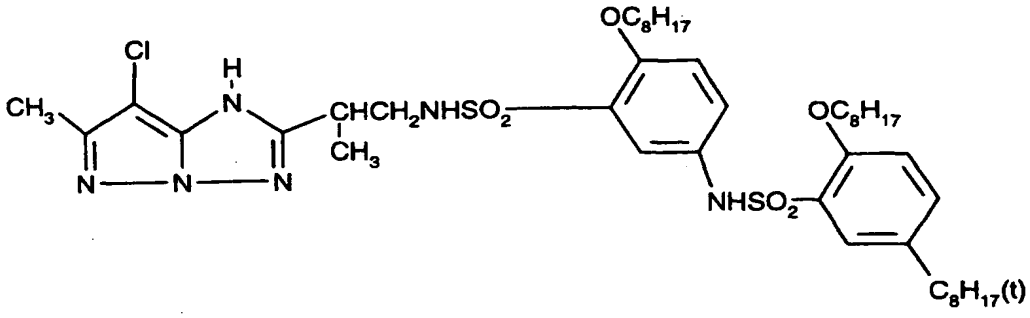

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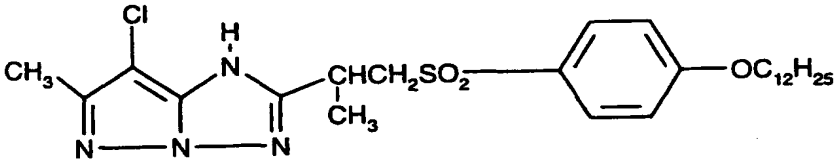

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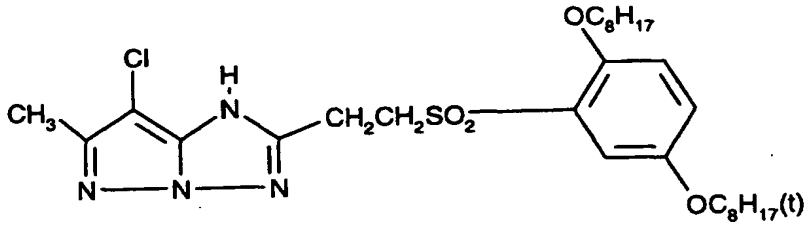

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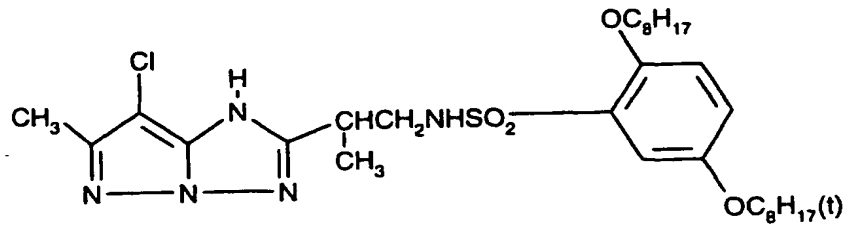

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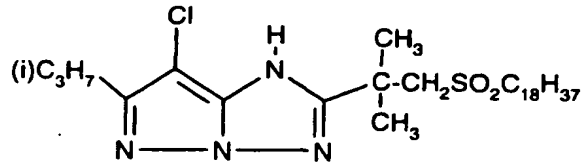

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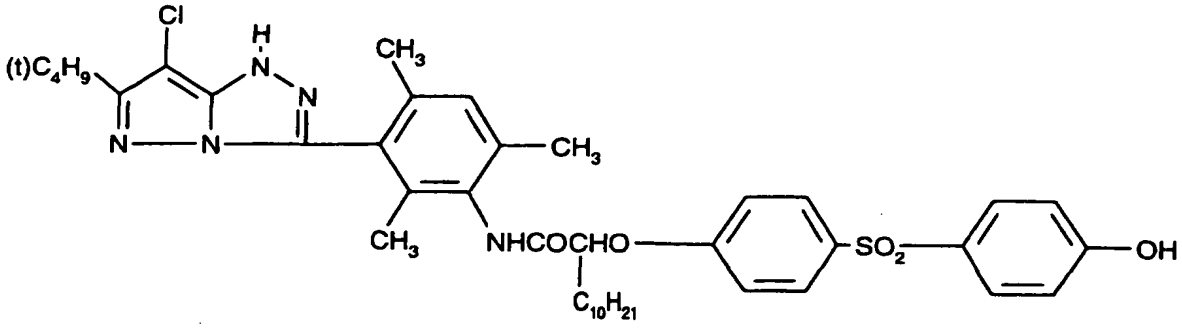

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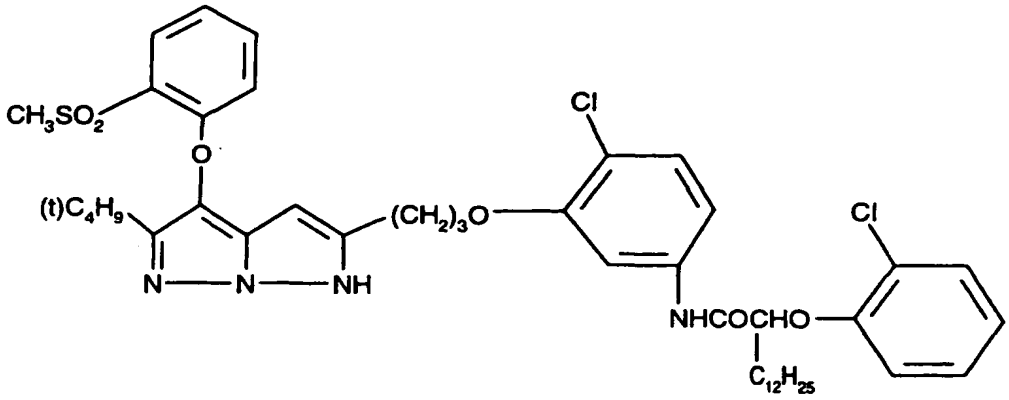

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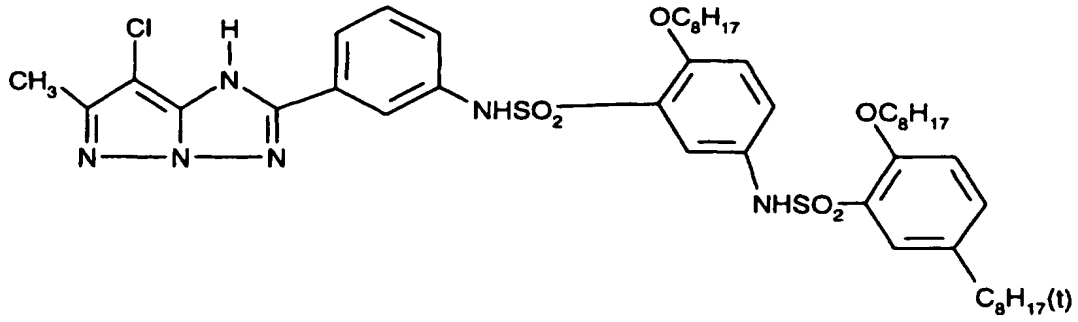

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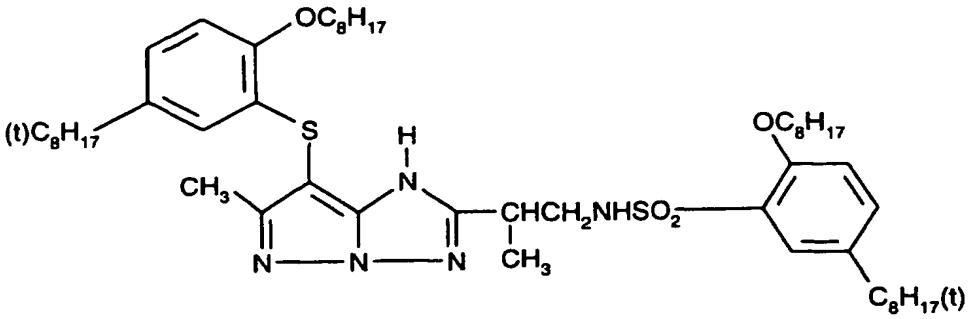

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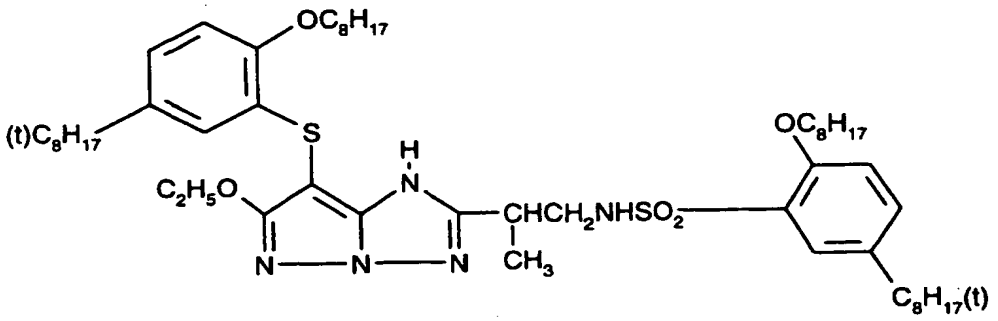

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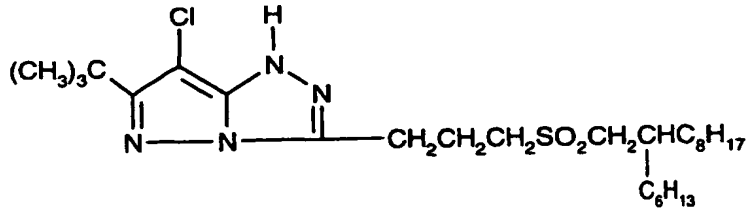

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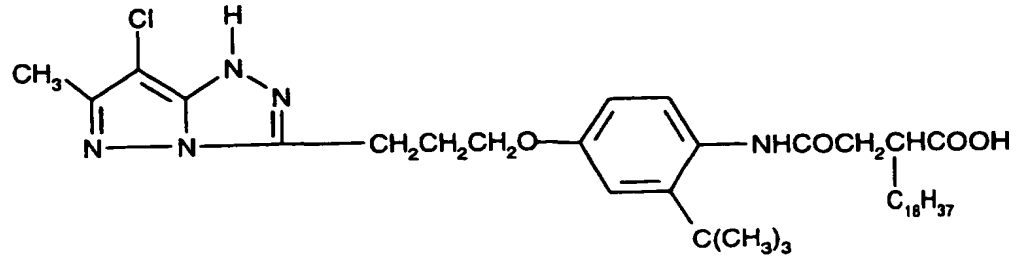

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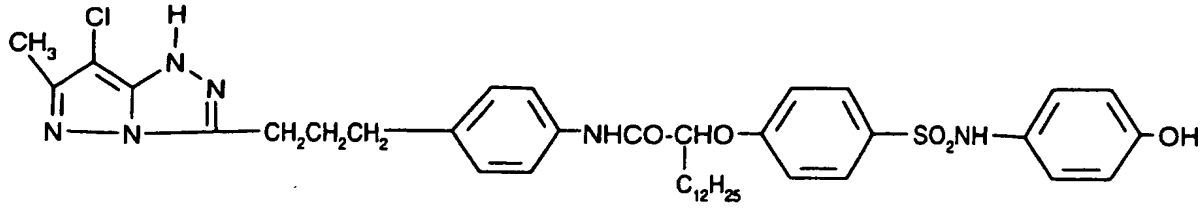

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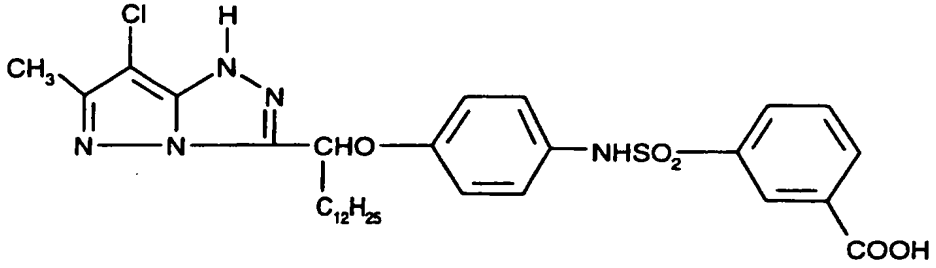

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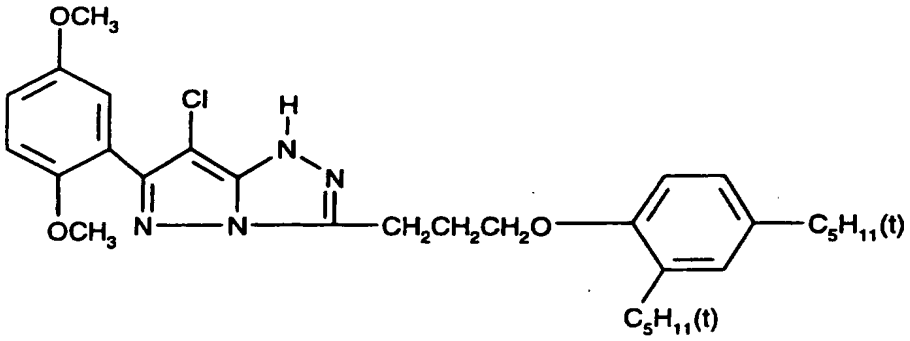

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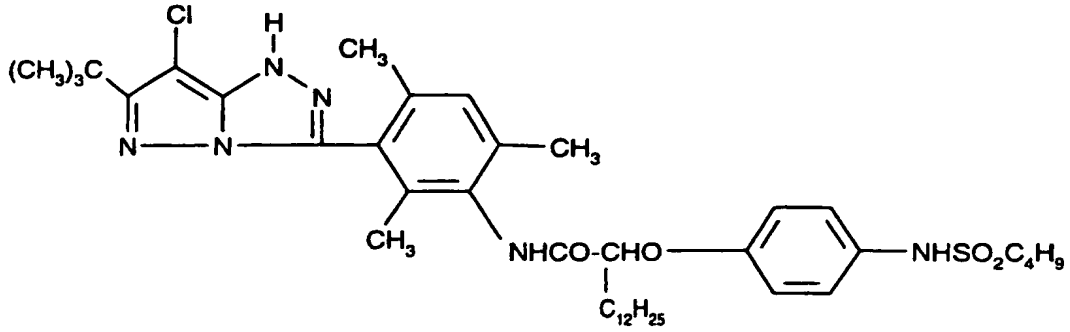

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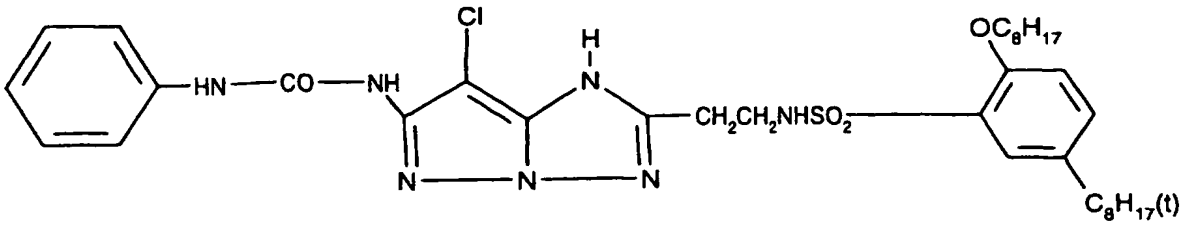

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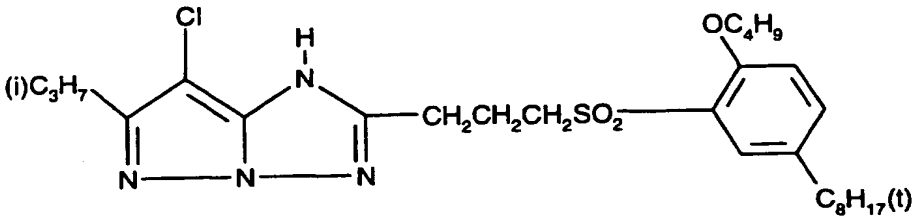

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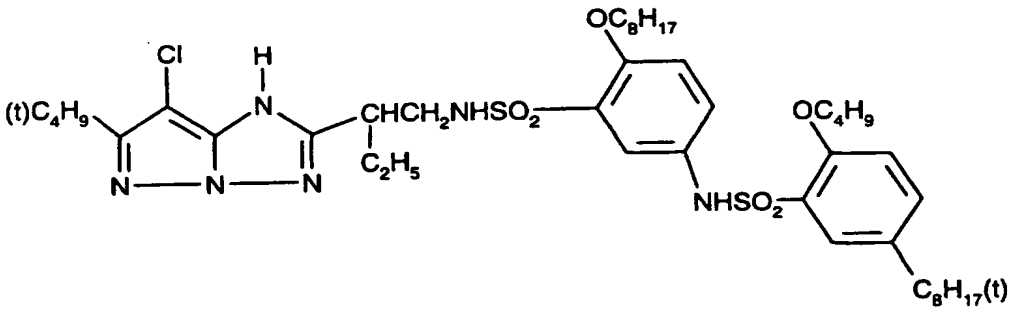

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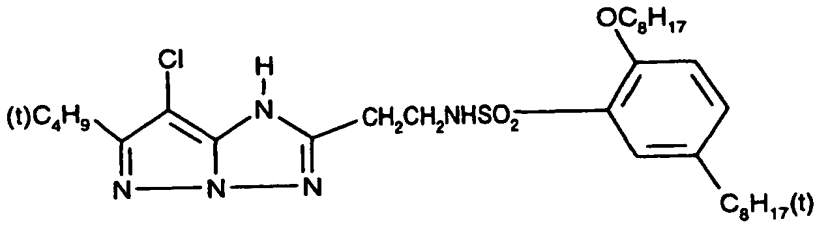

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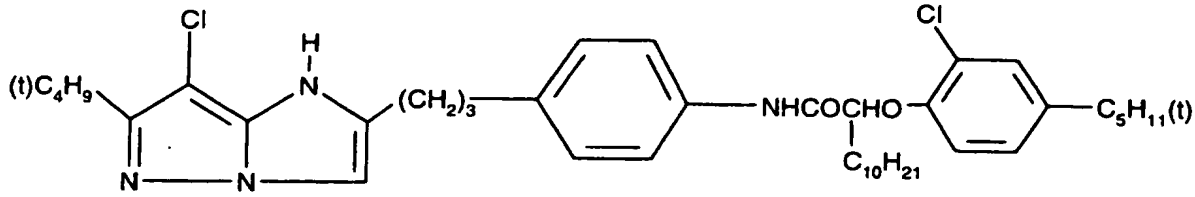

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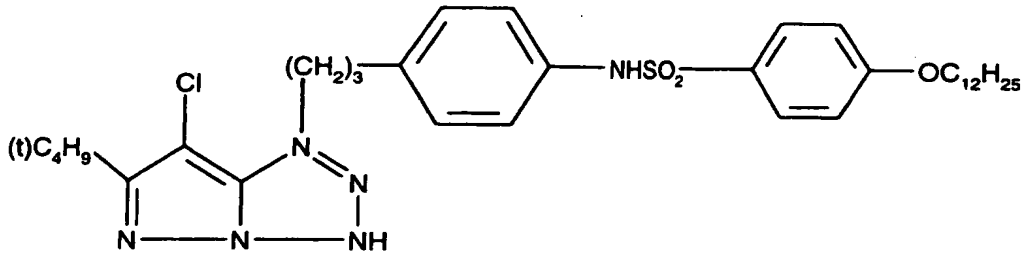

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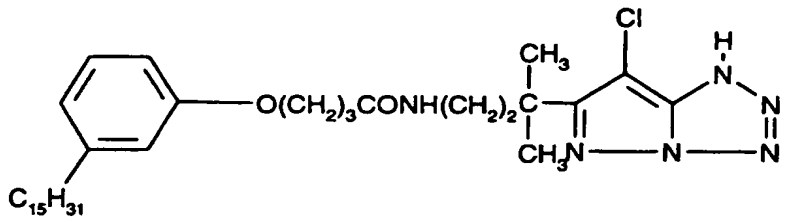

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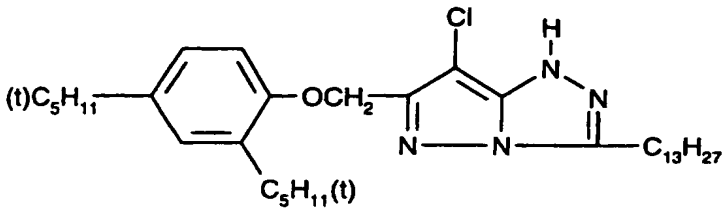

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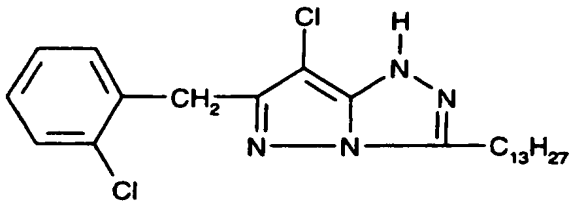

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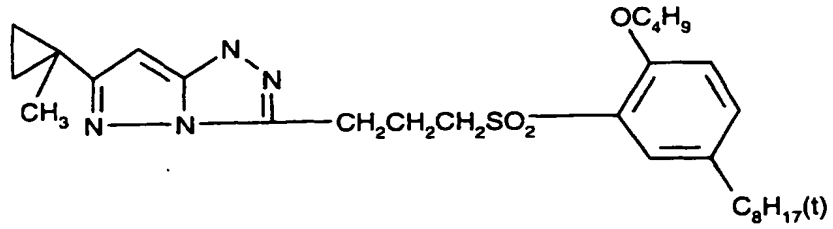

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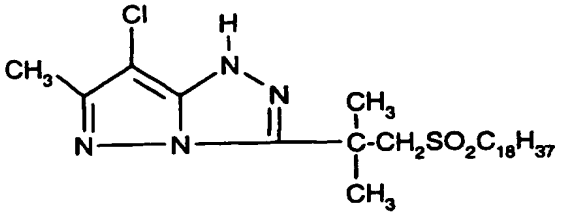

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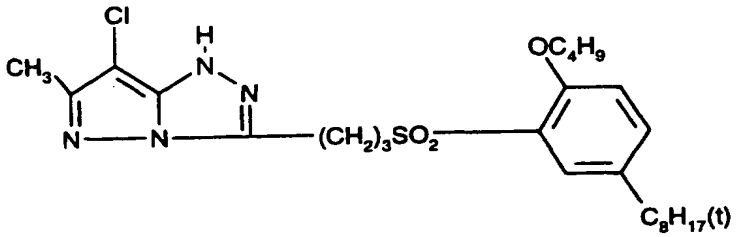

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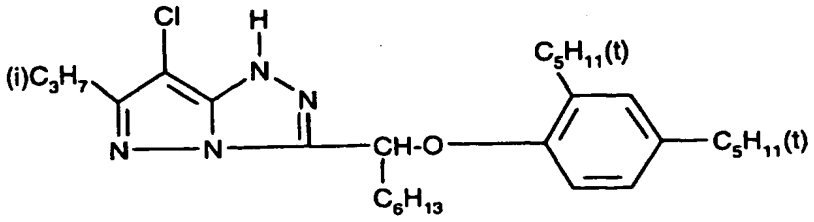

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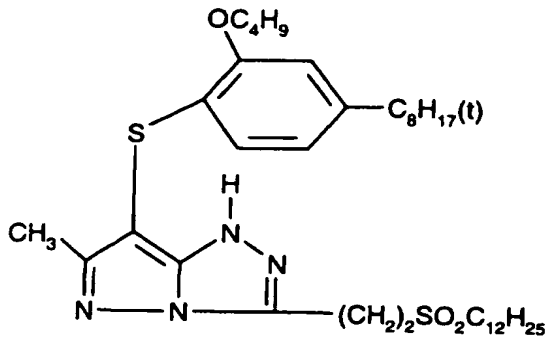

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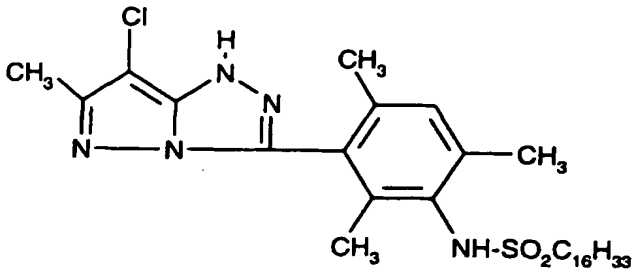

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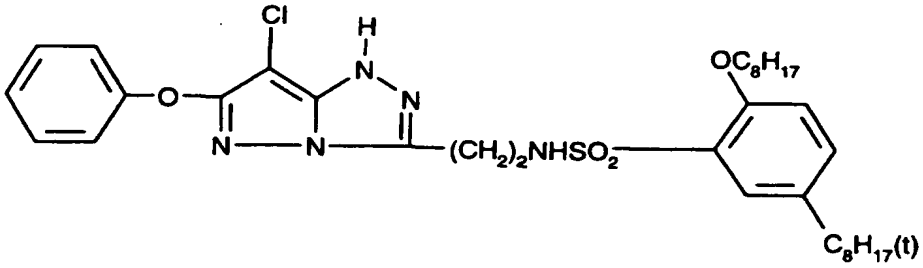

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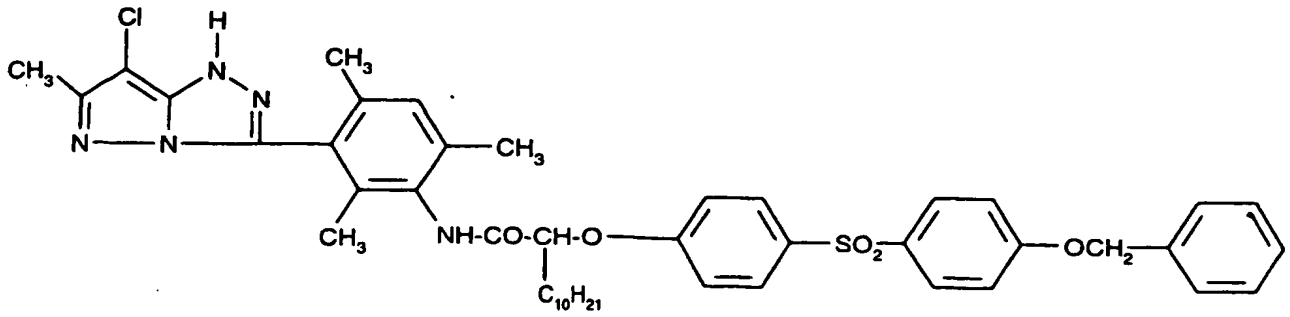

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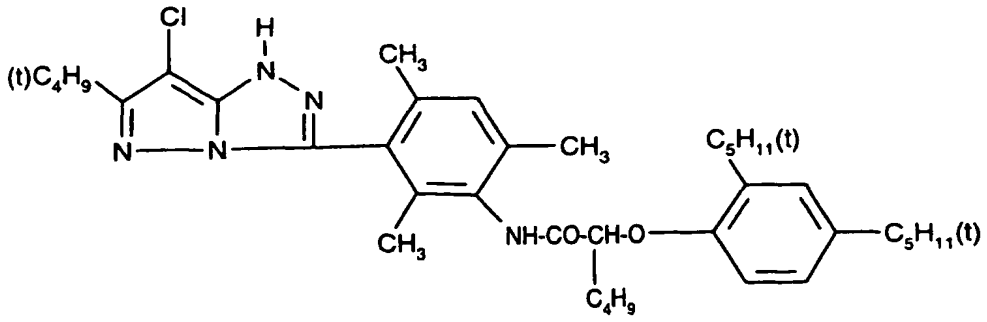

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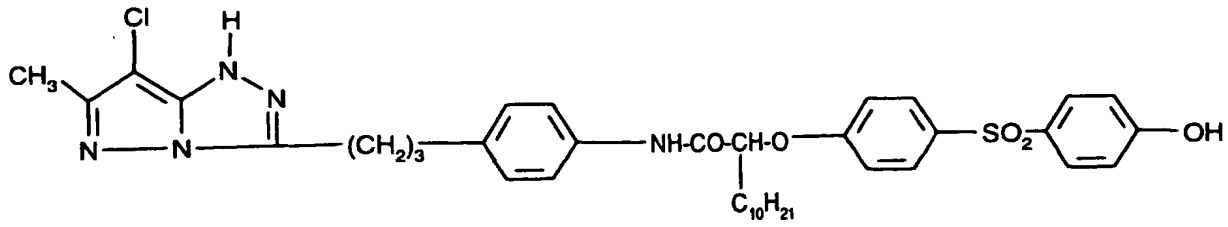

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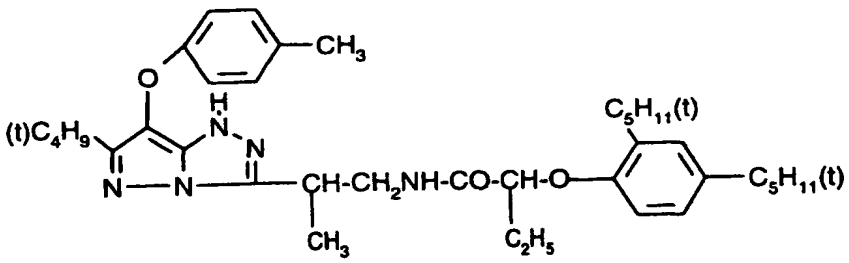

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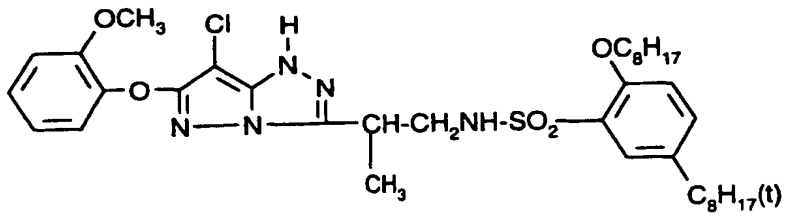

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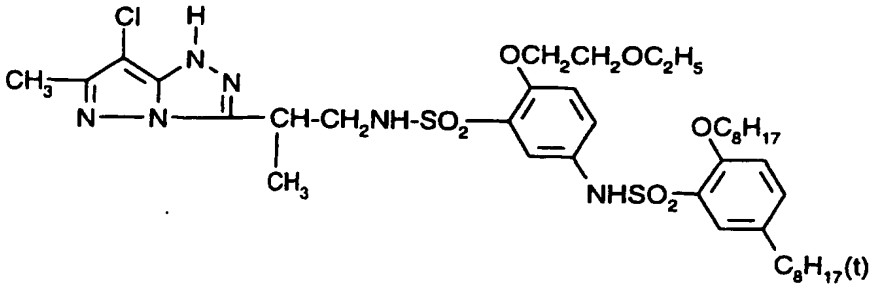

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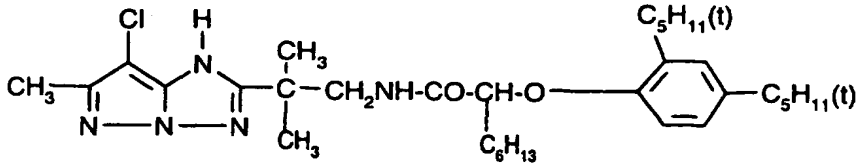

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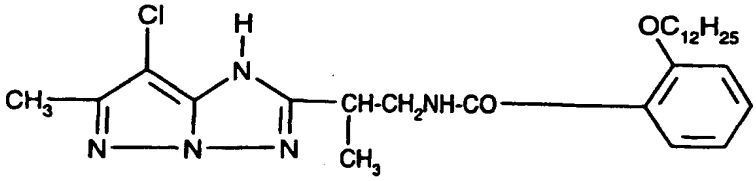

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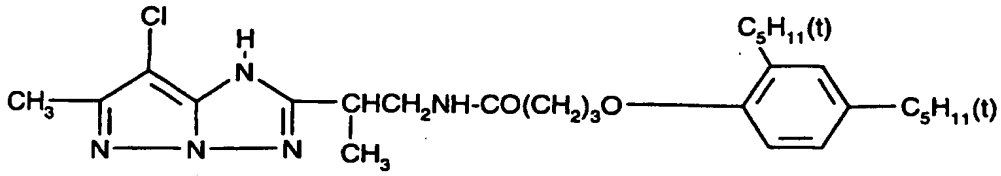

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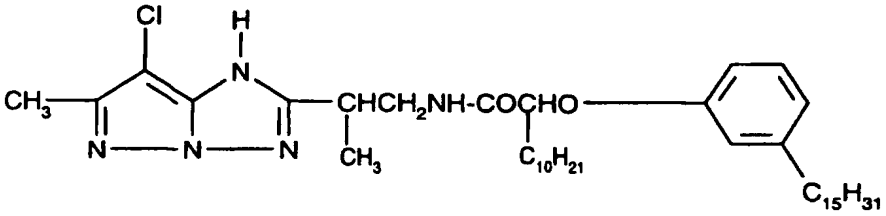

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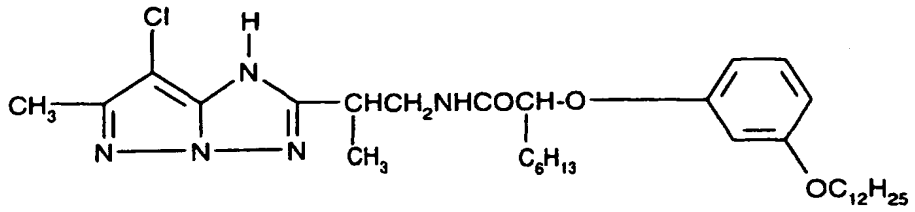

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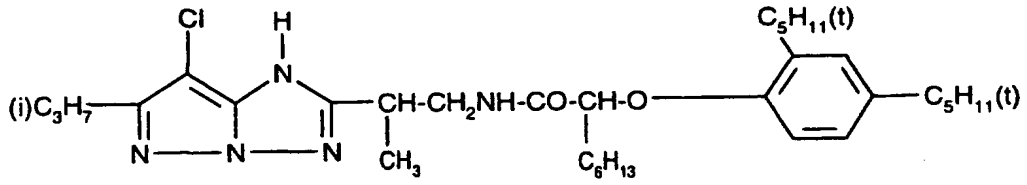

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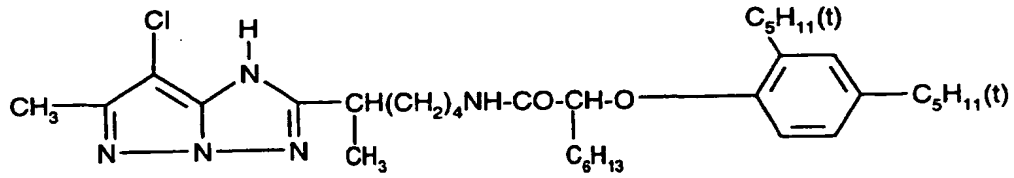

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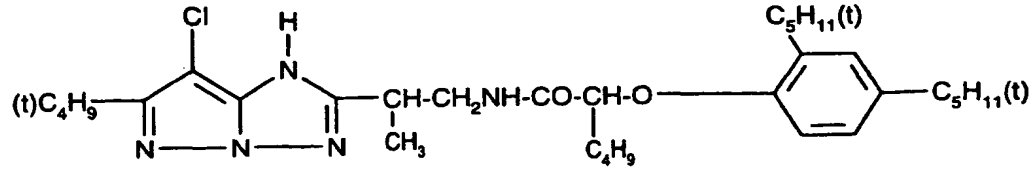

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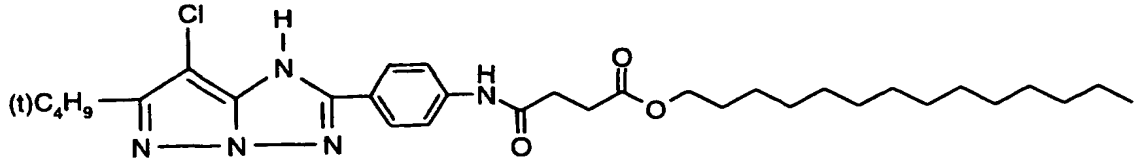
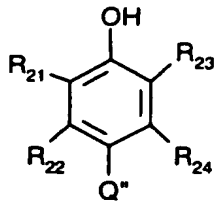


(M-68)

Cyan couplers can, for example, be derivatives of phenol, 1-naphthol, pyrazoloazole, pyrroloazole or of pyrazoloquinazolone. One group of cyan couplers is of the formula E

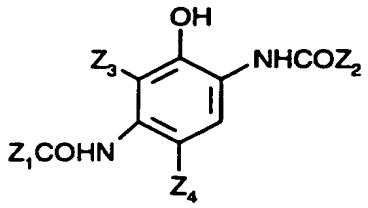


(E),

in which R_{21}, R_{22}, R_{23} and R_{24} are hydrogen, halogen, alkyl, carbamoyl, amino, sulfonamido, phosphoramido or ureido. R_{21} is preferably H or Cl, R_{22} is preferably an alkyl or amino group. R_{23} is preferably an amino group and R_{24} is preferably hydrogen. Q" is hydrogen (4-equivalent coupler) or a leaving group (2-equivalent coupler) which is eliminated on reaction with the oxidized developer. An exhaustive listing of cyan couplers can be found in US-A-4,456,681.

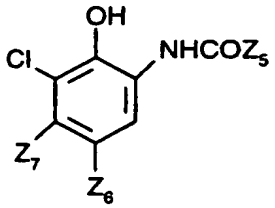
The cyan couplers employed in the red-sensitive silver halide emulsion layer of the novel material are preferably of the formula

(E-12)



and/or of the formula

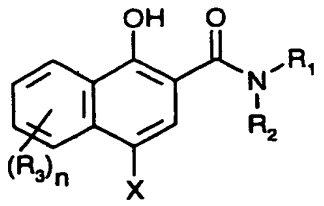
(E-13)



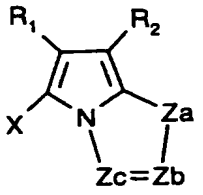
in which

Z_1 is alkyl, aryl, Z_2 is alkyl, cycloalkyl, aryl, a heterocyclic group or a ballast group, Z_3 is hydrogen or halogen, Z_1 and Z_3 together can form a ring, and Z_4 is hydrogen or a leaving group, and Z_5 is a ballast group, Z_6 is hydrogen or a leaving group and Z_7 is alkyl

and/or also those of the formulae E20 and E21

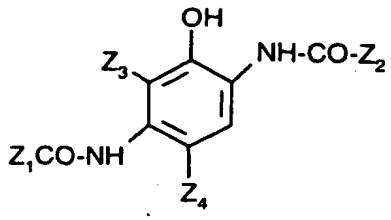
(E-20) 

in which R_1 is preferably substituted phenyl and R_2 and R_3 are preferably H and X is preferably H or a group which is cleaved by reaction with the oxidized form of the developer, and

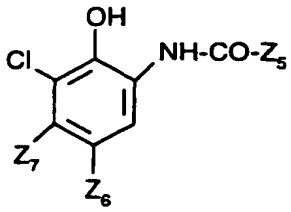
(E-21) 

in which Za is -NH- or -CH(R_3)-; Zb and Zc independently of one another are -C(R_4)= or -N=; R_1, R_2 and R_3 are each an electron-attracting group having a Hammett substituent constant σ_p of at least 0.2, with the sum of the σ_p values of R_1 and R_2 being at least 0.65; R_4 is H or a substituent, and if two R_4s are present in the formula, they can be identical or different; and X is H or a group capable of elimination in the coupling reaction with the oxidation product of an aromatic primary amine as colour developer; or R_1, R_2, R_3, R_4 or X is a divalent group by means of which the cyan coupler is able to form a dimer or higher polymer, or to react with a polymer chain to form a homo- or copolymer.

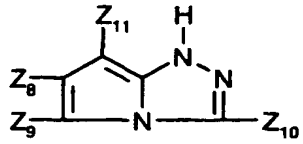
Preference is given to a photographic material in which the red-sensitive silver halide emulsion layer comprises a cyan coupler of one of the formulae C1, C2, C3, C4, C5, C6, C7 and C8



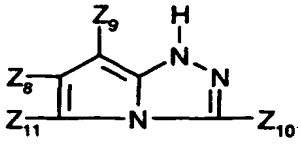
C1



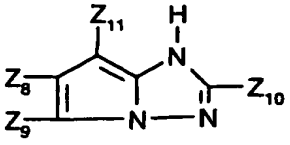
C2



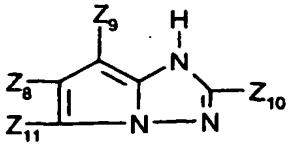
C3



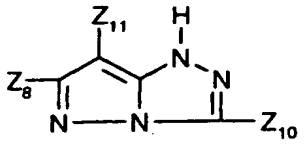
C4



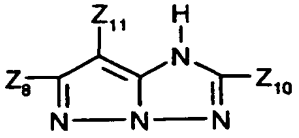
C5



C6



C7



C8

in which

Z_1 is alkyl or aryl,

Z_2 is alkyl, cycloalkyl, aryl, a heterocyclic group or a ballast group,

Z_3 is H or halogen, or Z_1 and Z_3 together form a ring,

Z_4 is H or a leaving group,

Z_5 is a ballast group,

Z_6 is H or a leaving group,

Z_7 is alkyl,

Z_8 and Z_9 independently of one another are H or a substituent, at least one of the groups Z_8 and Z_9 being an electron-withdrawing group having a Hammett constant ($-\sigma_p$) of 0.15 or more [Z_8 and Z_9 can be connected to one another to form a ring structure];

Z_{10} is a substituent and

Z_{11} is H or a leaving group.

The cyan couplers can also be connected to one another by way of the radicals Z_8, Z_9, Z_{10} or Z_{11} to form dimers or polymers.

Suitable leaving groups are in general those substituents which are set free after coupling with the oxidation product of a colour developer based on aromatic primary amines.

The novel photographic material preferably comprises those cyan couplers of the formulae C1-C8 in which

Z_1 is alkyl or aryl,

Z_2 is alkyl, aryl, or a ballast group,

Z_3 is H or halogen,

Z_4 is H or a leaving group,

Z_5 is a ballast group,

Z_6 is H or a leaving group,

Z_7 is alkyl,

Z_8 and Z_9 independently of one another are CN, CF_3, $COOZ_{12}$, COZ_{12}, SO_2Z_{12}, $CON(Z_{13})Z_{14}$, $SO_2N(Z_{13})Z_{14}$, and

Z_{12} is unsubstituted alkyl or aryl,

Z_{13} and Z_{14} independently of one another are unsubstituted or substituted alkyl, aryl, heterocyclyl, alkoxy, aryloxy or heterocyclyloxy, and

Z_{13} can also be H;

Z_{10} embraces the definitions given for Z_8 and Z_9 or is alkyl, aryl, heterocyclyl, nitro, NH-CO-Z_{15}, $N(Z_{15})Z_{16}$, NH-CO-$N(Z_{15})Z_{16}$, NH-$SO_2N(Z_{15})$, S-Z_{15}, NH-CO-OZ_{15}, NH-$SO_2N(Z_{15})Z_{16}$, SOZ_{15}, and

Z_{15} and Z_{16} are each a substituent, and Z_{16} can also be H.

The colour developers usually used for colour photographic recording materials are p-dialkylaminoanilines. Examples of these are 4-amino-N,N-diethylaniline, 3-methyl-4-amino-N,N-diethylaniline, 4-amino-N-ethyl-N-α-hydroxyethylaniline,

3-methyl-4-amino-N-ethyl-N-α-hydroxyethylaniline,

3-methyl-4-amino-N-ethyl-N-α-hydroxyethylaniline,

3-methyl-4-amino-N-ethyl-N-α-methanesulfonamidoethylaniline,

3-methyl-4-amino-N-ethyl-N-α-methoxyethyl-aniline,

3-α-methanesulfonamidoethyl-4-amino-N,N-diethylaniline,

3-methoxy-4-amino-N-ethyl-N-α-hydroxyethylaniline,

3-methoxy-4-amino-N-ethyl-N-α-methoxyethylaniline,

3-acetamido-4-amino-N,N-diethylaniline, 4-amino-N,N-dimethylaniline,

N-ethyl-N-α-[α'-(α"-methoxyethoxy)ethoxy]ethyl-3-methyl-4-aminoaniline,

N-ethyl-N-α-(α'-methoxyethoxy)ethyl-3-methyl-4-aminoaniline, and also the salts of such compounds, for example sulfates, hydrochlorides or toluenesulfonates.

The compounds of the formula (I) which can be used in the context of this invention can be incorporated into the colour photographic recording material, on their own or together with the colour coupler and with or without further additives, by predissolving them in high-boiling organic solvents. Preference is given to the use of solvents which boil at higher than 160°C. Typical examples of these solvents are the esters of phthalic acid, phosphoric acid, citric acid, benzoic acid or of fatty acids, and also alkylamides and phenols.

A low-boiling solvent is usually used in addition in order to simplify incorporation of the additives into the colour-photographic recording material. Examples of such solvents are esters, for example ethyl acetate, alcohols, for example butanol, ketones, for example methyl isobutyl ketone, chlorinated hydrocarbons, such as methylene chloride, and amides, such as dimethylformamide. Where the additives themselves are liquid, they can also be incorporated into the photographic material without the assistance of solvents.

The novel compounds of the formula (I) may if desired be dispersed in the gelatine layer without oil, as described Research Disclosure, Items 296017 (1988) and 303070 (1989).

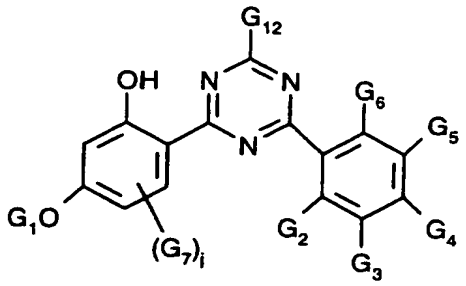
The photographic layers in the material of this invention may also include UV absorbers, which screen out the UV light and therefore protect the dyes, the couplers or other components against photodegradation. Benzofuran-2-ones compounds according to this invention may be contained in those layers where UV absorbers are present.

UV absorbers preferably to be used in the novel material or within the process of present invention include benzotriazoles, 2-hydroxybenzophenones, oxanilides, cyanoacrylates, salicylic esters, acrylonitrile derivatives, thiazolines and 2-hydroxyphenyltriazines.

Such UV absorbers are described in more detail, for example, in the following publications: DE 19750906, US-A-3,314,794, 3,352,681, 3,705,805, 3,707,375, 4,045,229, 3,700,455, 3,700,458, 3,533,794, 3,698,907, 3,705,805, 3,738,837, 3,762,272, 4,163,671, 4,195,999, 4,309,500, 4,431,726, 4,443,543, 4,576,908, 4,749,643, 4,826,978, 5,500,332, 5,455,152, 5,300,414, 5,489,503, 5,480,108, 5,364,749, GB-A-1,564,089, GB-A-2,293,608, EP-A-190003, -747755, -717313 and JP-A-71/2784, 81/111,826, 81/27,146, 88/53,543, 88/55,542 and 96/69087.

Examples of particularly suitable UV absorbers are:

2-Hydroxyphenyltriazines of the formula



in which j is 0, 1, 2 or 3;

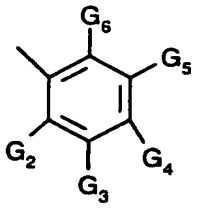
G_1 is alkyl, alkenyl or cycloalkyl;

G_2 and G_6 independently of one another are H, OH, halogen, alkyl, alkoxy, halomethyl, for example CF_3;

G_3, G_5 and G_7 independently of one another are H, OH, OG_1, halogen, alkyl, halomethyl, for example CF_3;

G_4 is H, OH, OG_1, halogen, alkyl, phenyl, halomethyl, for example CF_3, or alkenyl; and

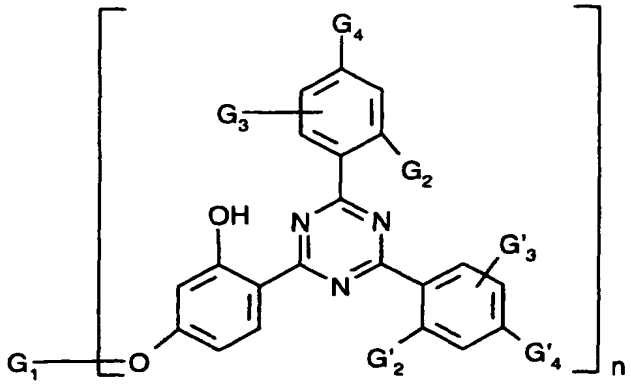
G_{12} is alkyl, phenylalkyl, cycloalkyl, OG_1, or in particular, a group of the formula



Alkyl or alkenyl substituents, or substituents which are aromatic or aliphatic ring systems, usually contain - within the context of the stated definitions - from 1 to 50 carbon atoms and can be interrupted one or more times by O, S, NR', SO_2, CO, phenylene, cyclohexylene, COO, OCO, -(SiR_pR_qO)- and/or substituted one or more times by OH, OR', NR'R", halogen, -CN, alkenyl, phenyl, -$SiR_pR_qR_r$ or COOH, where R' and R" independently of one another are H, alkyl, alkenyl or acyl, and R_p, R_q and R_r independently of one another are H, alkyl, alkenyl, phenyl, alkoxy, acyl or acyloxy.

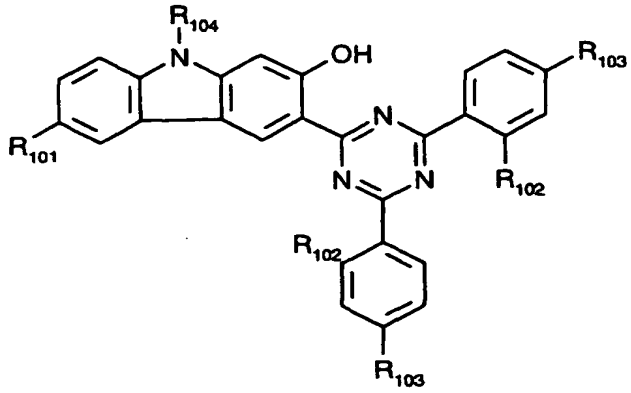
The abovementioned groups can also carry other substituents as well. Dimers or polymers are also possible.

Preferred 2-hydroxyphenyltriazines of this class are, for example, those of the formula



(AIII)

or



(A V)

where, in formula AIII

n is 1 or 2 and

G_1, if n = 1, is alkyl which is uninterrupted and unsubstituted or is interrupted by one or more O and/or substituted by one or more of the radicals OH, glycidyloxy, alkenoxy, COOH, $COOR^e$, O-CO-R^f, or is alkenyl, cycloalkyl, unsubstituted or OH-, Cl- or CH_3-substituted phenylalkyl; or COR^g; SO_2-R^h; $CH_2CH(OH)$-R^i; where

R^e is alkyl; alkenyl; hydroxyalkyl; alkyl or hydroxyalkyl interrupted by one or more O; cycloalkyl; benzyl; alkylphenyl; phenyl; phenylalkyl; furfuryl; or $CH_2CH(OH)$-R^l;

R^f, R^g independently of one another are alkyl, alkenyl or phenyl;

R^h is alkyl, aryl or alkylaryl;

R^l is aralkyl or CH_2OR^k;

R^k is cyclohexyl, phenyl, tolyl or benzyl; and

G_1, if n = 2, is alkylene; alkenylene; xylylene; alkylene or hydroxyalkylene interrupted by one or more O; hydroxyalkylene;

G_2 and G'_2 independently of one another are H, alkyl, alkoxy or OH;

G_4 and G'_4 independently of one another are H, alkyl, OH, alkoxy, halogen, and, if n = 1, OG_1;

G_3 and G'_3 independently of one another are H, alkyl or halogen; and

where, in formula AV,

R_{101} is H, C_1-C_8alkyl, C_1-C_8alkoxy;

R_{102} and R_{103} independently of one another are H, halogen, OH, C_1-C_8alkyl, C_1-C_8alkoxy;

R_{104} is H, OH, C_1-C_8alkyl; C_1-C_8alkoxy.

Within the scope of the stated definitions G_1, G_2, G'_2, G_3, G'_3, G_4 and G'_4 may also carry additional substituents, for example an ethylenically unsaturated, polymerizable group. Dimers or polymers are also possible.

Particular preference is given to colour photographic materials in accordance with the present invention, in which at least one of the layers comprises a UV absorber of the formula A III in which

n is 1;

G_1 is C_1-C_{12}alkyl which is unsubstituted or substituted by OH or $COOR^e$; or is C_2-C_{12}alkyl or C_3-C_{15}hydroxyalkyl, interrupted by one or more O; or is C_3-C_6alkenyl; cyclohexyl; C_7-C_{11}phenylalkyl; $CH_2CH(OH)$-R^j; where

R^e is C_1-C_{18}alkyl; C_3-C_7alkenyl; alkyl or hydroxyalkyl interrupted by one or more O;

R^j is C_7-C_{12}aralkyl or CH_2OR^k;

R^k is cyclohexyl, phenyl, tolyl or benzyl; and

G_2 and G'_2 are OH or alkoxy;

G_4 and G'_4 are OG_1;

G_3 and G'_3 independently of one another are H or methyl;

especially those in which

n is 1;

G_1 is C_1-C_{12}alkyl which is unsubstituted or substituted by $COOR^e$; or is C_3-C_{15}hydroxyalkyl which is interrupted by O; or is allyl, cyclohexyl or benzyl; where

R^e is C_1-C_{12}alkyl; allyl; C_3-C_{12}alkyl which is interrupted by one or more O;

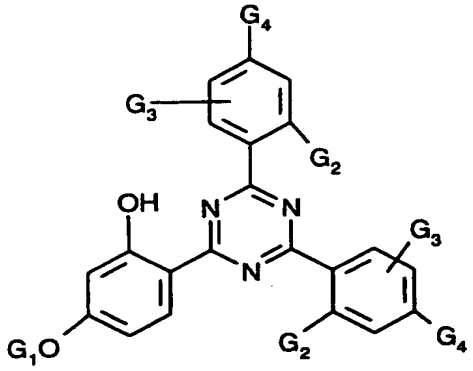
G_2 and G'_2 are OH or alkoxy;

G_4 and G'_4 are OG_1;

G_3 and G'_3 are H.

Examples of such compounds include
2,4,6-tris(2-hydroxy-4-octyloxyphenyl)-1,3,5-triazine,
2-(2,4-dihydroxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine,
2,4-bis(2-hydroxy-4-propyloxyphenyl)-6-(2,4-dimethylphenyl)-1,3,5-triazine,
2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(4-methylphenyl)-1,3,5-triazine,
2-(2-hydroxy-4-dodecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine,
2-[2-hydroxy-4-(2-hydroxy-3-butyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5--triazine,
2-[2-hydroxy-4-(2-hydroxy-3-octyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5--triazine,
2-[2-hydroxy-4-(2-hydroxy-3-tridecyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5--triazine; and compounds of the following formulae:

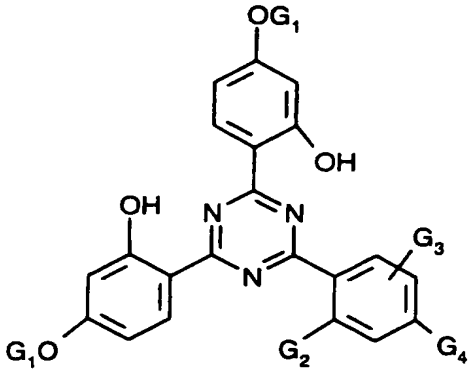
Type (HPT-I)



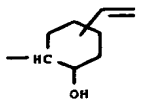
:

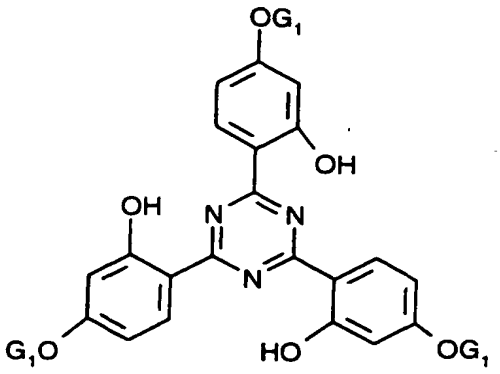
No.	G_1	G_2	G_4	G_3
HPT-1	$CH_2CH(OH)CH_2O$-CO-$C(CH_3)=CH_2$	CH_3	CH_3	H
HPT-2	$CH_2CH(OH)CH_2OC_{12}H_{25}/C_{13}H_{27}$(mixture)	CH_3	CH_3	H
HPT-3	$CH_2CH(OH)CH_2O$-C_4H_9(n)	CH_3	CH_3	H
HPT-4	CH_2COO-$C_{18}H_{37}$	H	H	m-CF_3
HPT-5	C_8H_{17}	CH_3	CH_3	H
HPT-6	$CH_2CH(OH)CH(C_2H_5)$-C_4H_9(n)	CH_3	CH_3	H
HPT-7	H	CH_3	CH_3	H
HPT-8	CH_2CH_2OH	H	H	H
HPT-9	C_8H_{17}	H	H	H

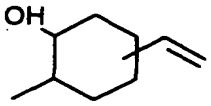
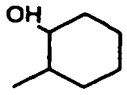
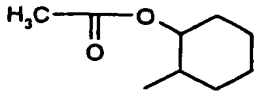
Type (HPT-II) :



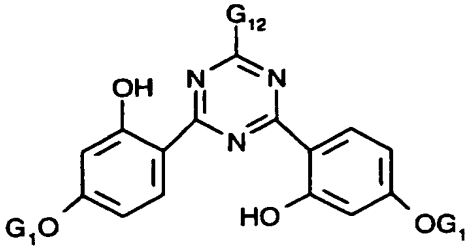
No.	G_1	G_2	G_4	G_3
HPT-10	$C_{18}H_{37}$	CH_3	CH_3	o-CH_3
HPT-11	$CH_2CH(OH)CH_2O$-C_4H_9(n)	H	H	H
HPT-12	$CH_2CH(OH)CH_2O$-C_4H_9(n)	CH_3	CH_3	H
HPT-13	$CH_2CH(OH)CH_2O$-C_4H_9(n)	CH_3	CH_3	o-CH_3
HPT-14	$CH_2CH(OH)$-C_4H_9(n)	CH_3	CH_3	o-CH_3
HPT-15	$CH(OH)$-C_5H_{11}(n)	CH_3	CH_3	o-CH_3
HPT-16	C_8H_{17}	H	Cl	H
HPT-17	$CH(CH_3)$-COO-C_2H_5	CH_3	CH_3	o-CH_3
HPT-18	$CH_2CH(OCOCH_3)CH(C_2H_5)$-$C_4H_9$(n)	H	H	H
HPT-19	$CH_2CH(OH)CH(C_2H_5)$-C_4H_9(n)	H	H	H
HPT-20	CH_2CH_2-O-CO-$C(CH_3)_3$	H	H	H
HPT-21	H	H	H	H
HPT-22	$(CH_2)_{10}COO$-C_2H_5	H	Cl	H
HPT-23	$(CH_2)_5COOH$	H	H	H
HPT-24	$CH_2CH(C_2H_5)$-C_4H_9(n)	H	H	H
HPT-25	$CH_2CH(OH)CH_2$-O-C_4H_9(n)	H	t-C_4H_9	H
HPT-26	$CH_2CH(OH)CH_2$-O-C_4H_9(n)	H	OCH_3	H
HPT-27	$(CH_2)_3$-$Si(CH_3)_3$	H	H	H
HPT-28	CH_2-$CH(OH)$-CH_2-O-C_4H_9-n	OCH_3	OG_1	H
HPT-29	CH_2-$CH(OH)$-CH_2-O-C_4H_9-n	OC_2H_5	OG_1	H
HPT-30	CH_2-$CH(OH)$-CH_2-O-C_4H_9-n	OG_1	OG_1	H
HPT-31	$CH(CH_3)$-CO-O-C_2H_5	OC_2H_5	OG_1	H
HPT-32	$CH(CH_3)$-CO-O-C_2H_5	OG_1	OG_1	H

HPT-33	 (mixture of 4-vinyl- and 5-vinyl-2-hydroxy-cyclohexyl)	OCH_3	OG_1	H
HPT-34	C_2H_5	OG_1	OG_1	H
HPT-35	CH_2-$CH(C_2H_5)$-C_4H_9-n	OG_1	OG_1	H
HPT-36	$(CH_2)_7$-CH_3	OG_1	OG_1	H
HPT-37	n-propyl	OCH_3	OG_1	H
HPT-38	n-propyl	O C_2H_5	OG_1	H
HPT-39	n-propyl	OG_1	OG_1	H
HPT-40	iso-propyl	OCH_3	OG_1	H
HPT-41	iso-propyl	OC_2H_5	OG_1	H
HPT-42	iso-propyl	OG_1	OG_1	H
HPT-43	n-butyl	OCH_3	OG_1	H
HPT-44	n-butyl	OC_2H_5	OG_1	H
HPT-45	n-butyl	OG_1	OG_1	H
HPT-46	$CH(CH_3)C_2H_5$	OCH_3	OG_1	H
HPT-47	$CH(CH_3)C_2H_5$	OC_2H_5	OG_1	H
HPT-48	$CH(CH_3)C_2H_5$	OG_1	OG_1	H
HPT-49	n-hexyl	OCH_3	OG_1	H
HPT-50	n-hexyl	OC_2H_5	OG_1	H
HPT-51	n-hexyl	OG_1	OG_1	H
HPT-52	n-octyl	OCH_3	OG_1	H
HPT-53	n-octyl	OC_2H_5	OG_1	H
HPT-54	n-octyl	OG_1	OG_1	H
HPT-55	$CH_2CH(CH_3)_2$	OG_1	OG_1	H
HPT-56	$CH_2CH_2CH(CH_3)_2$	OG_1	OG_1	H
HPT-57	CH2-COO-Et	OC_2H_5	OG_1	H
HPT-58	CH2-COO-Et	OG_1	OG_1	H

Type (HPT-III)  :

No.	G_1
HPT-59	cyclohexyl
HPT-60	 (mixture of 4-vinyl- and 5-vinyl-2-hydroxy-cyclohexyl)
HPT-61	$CH_2CH(OH)CH_2$-O-2-butyl/2-pentyl (mixture)
HPT-62	$CH_2CH(OH)CH_2$-O-C_4H_9(n)
HPT-63	$(CH_2)_{10}COO$-C_2H_5
HPT-64	$CH_2CH(OH)CH(C_2H_5)$-C_4H_9(n)
HPT-65	C_4H_9
HPT-66	$CH_2CH(OH)CH_2$-O-ethyl/isopropyl/C_4H_9(n) (mixture)
HPT-67	$CH(C_3H_7)_2$
HPT-68	cyclopentyl
HPT-69	$CH_2CH(OH)CH_2$-O-CH_2CH_2-O-$CH(CH_3)C_2H_5$
HPT-70	
HPT-71	
HPT-72	$C(CH_3)_2$-COO-C_2H_5
HPT-73	$CH(CH_3)$-COO-C_2H_5
HPT-74	$CH_2CH(OH)CH_2$-O-$CH(CH_3)$-C_2H_5/C_3H_7
HPT-75	$(CH_2)_5$-CH_3

Type (HPT-IV)

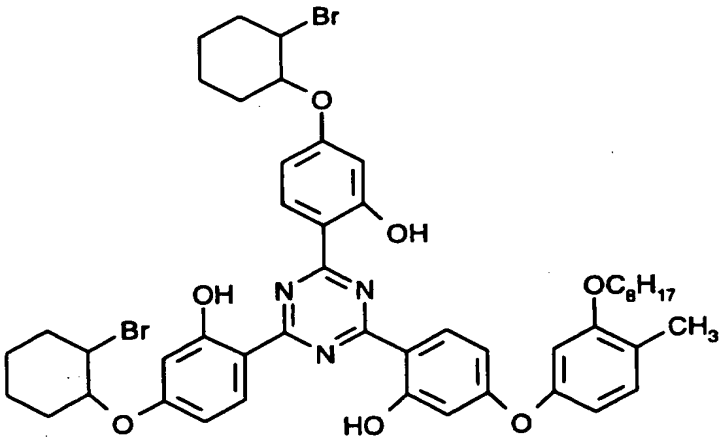


:

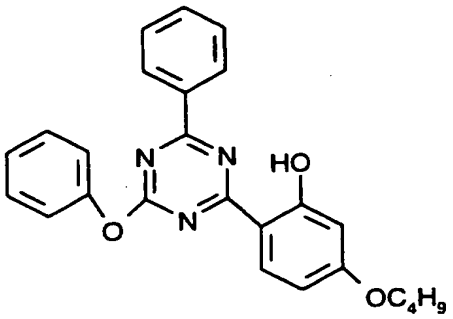
No.	G_1	G_{12}
HPT-76	CH_3	$OCH_2CH_2OC_2H_5$
HPT-77	$CH_2CH(OCOCH_3)CH(C_2H_5)$-$C_4H_9$(n)	OCH_3
HPT-78	$CH_2CH_2CH_2$-O-CO-C_2H_5	OCH_3
HPT-79	$CH_2CH(OH)CH_2$-O-C_4H_9(n)	CH_3
HPT-80	$CH_2CH(OH)CH_2$-O-C_4H_9(n)	OCH_3

and

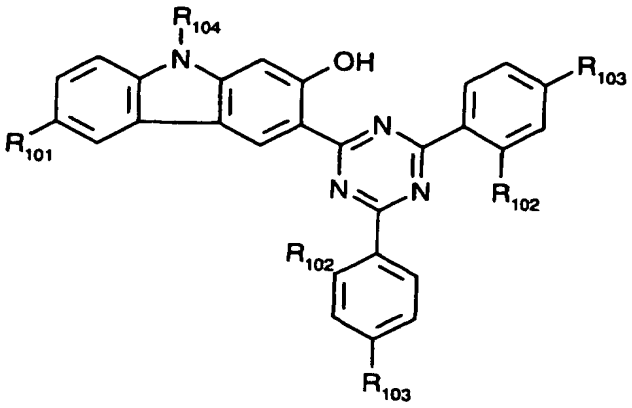
HPT-81



HPT-82



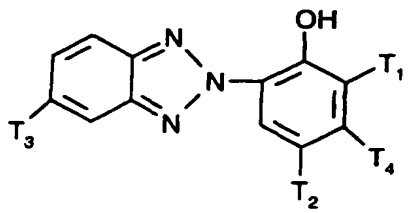
Type (HPT-V)



No.	R_{101}	R_{102}	R_{103}	R_{104}
HPT-83	H	H	H	H
HPT-84	H	CH_3	CH_3	H
HPT-85	H	OH	H	H
HPT-86	H	OH	H	CH_3
HPT-87	H	OCH_3	OCH_3	H
HPT-88	CH_3	H	H	H

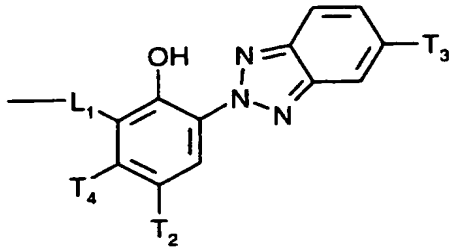
Abbreviations used in above formulae:
i = isomer mixture; n = straight-chain radical; t = tertiary radical; o-, m- and p- denote the position of the radical relative to the triazine ring.

Benzotriazole compounds of the formula AII



(AII)

in which T_1 and T_2 independently of one another are hydrogen, halogen, alkyl, alkyl substituted by $COOT_5$, alkoxy, aryloxy, hydroxyl, aralkyl, aryl or acyloxy, where T_5 is alkyl or alkyl interrupted by one or more O,

or T_1 is a group of the formula  in which L_1 is a bivalent

group, for example $-(CH_2)_n-$ where n is from the range 1-8,

T_3 is hydrogen, halogen, alkyl, alkoxy, aryloxy, acyloxy; $-CF_3$, phenyl, $-S-T_6$, $-SO_2-T_6$; and

T_4 is hydrogen, hydroxyl, alkoxy, aryloxy or acyloxy or a group of one of the formulae - $OCH_2CH(OT_8)-CH_2-O-T_7$ or $-OCH_2CH_2-O-CO-T_7$;

T_6 is alkyl or aryl;

T_7 is alkyl or aryl;

T_8 is hydrogen or $CO-T_9$;

T_9 is alkyl or alkenyl;

and polymers prepared using these compounds. Preference is given to those compounds of the formula A II which are liquid in the temperature range around 20°C or form a liquid phase in a mixture with other substances, especially to those in which

T_1 and T_2 independently of one another are hydrogen, halogen, alkyl, alkyl substituted by $COOT_5$, alkoxy, aryloxy, hydroxyl, aralkyl, aryl or acyloxy, where T_5 is alkyl or alkyl which is interrupted by one or more O.

Within the scope of the stated definitions T_1, T_2, T_3 and T_4 may also carry additional substituents, for example an ethylenically unsaturated, polymerizable group. Dimers or polymers are also possible.

Especial preference is given to those compounds of the formula AII, in which

T_1 is H, C_1-C_{12}alkyl, 1,1-dimethylbenzyl;

T_2 is H, C_1-C_{12}alkyl, 1,1-dimethylbenzyl or $CH_2CH_2COOT_5$;

T_3 is chlorine, CF_3, $-S-T_6$, $-SO_2-T_6$;

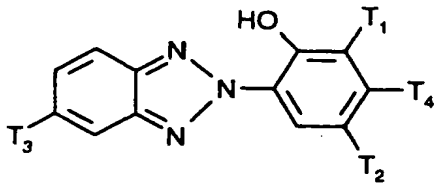
T_4 is hydrogen or C_1-C_{18}alkoxy;

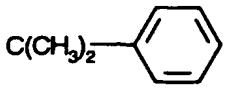
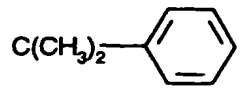
T_5 is C_1-C_{18}alkyl, or C_3-C_{18}alkyl interrupted by one or more O; and

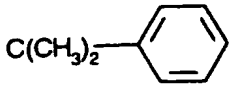
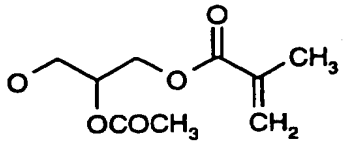
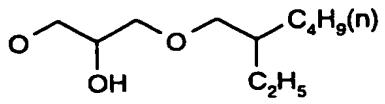
T_6 is phenyl.

The radicals designated as alkyl, alkenyl, aryl, arylalkyl, acyl, alkyloxy, alkenyloxy, aryloxy, arylalkyloxy and acyloxy for the conventional UV absorbers are generally those which are common in the art; preferred radicals are generally - as regards chain length, number of carbon atoms and any heteroatoms etc. - of the type as defined above for the novel compounds of the formula (I).

Examples of benzotriazoles (HBT) of the formula AII are:

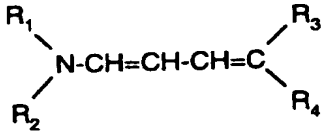


HBT-No.	T_1	T_2	T_3	T_4
HBT-1	H	CH_3	H	H
HBT-2	H	$C(CH_3)_3$	H	H
HBT-3	$C(CH_3)_3$	CH_3	Cl	H
HBT-4	$C(CH_3)_3$	$C(CH_3)_3$	Cl	H
HBT-5	$C(CH_3)_2C_2H_5$	$C(CH_3)_2C_2H_5$	H	H
HBT-6	$CH(CH_3)C_2H_5$	$C(CH_3)_3$	H	H
HBT-7			H	H
HBT-8	$C(CH_3)_3$	$CH_2CH_2COOC_8H_{17}$ (isomers)*	Cl	H
HBT-9	$C(CH_3)_3$	$CH_2CH_2COOC_8H_{17}$ (isomers)*	H	H
HBT-10	$C_{12}H_{25}$ (isomers)*	CH_3	H	H

HBT-11		$-C(CH_3)_2-C(CH_3)_3$	H	H
HBT-12	H	H	H	$O(CH_2)_2-O-CO-C(CH_3)=CH_2$
HBT-13	H	H	Cl	
HBT-14	H	H	H	
HBT-15	sec-C_4H_9	sec-C_4H_9	Cl	H

* main product

Other suitable UV absorbers are those of the formula AVI, AVII and AVIII

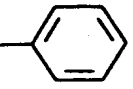


(AVI)

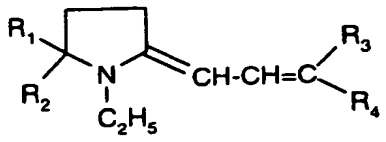
in which

R_1, R_2 = $-C_6H_{13}$(n); R_3, R_4 = -CN

R_1, R_2 = $-C_2H_5$; R_3 =  ; R_4 = $-CO-OC_8H_{17}$

R_1, R_2 = $-C_2H_5$; R_3 =  ; R_4 = $-COO-C_{12}H_{25}$

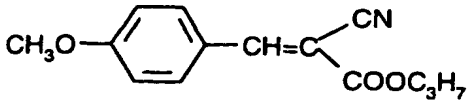
R_1, R_2 = $-CH_2=CH-CH_2$; R_3, R_4 = -CN



(AVII)

R_1, R_2 = H; R_3 = -CN; R_4 = -CO-$NHC_{12}H_{25}$

R_1, R_2 = -CH_3; R_3 = -CN; R_4 = -CO-$NHC_{12}H_{25}$

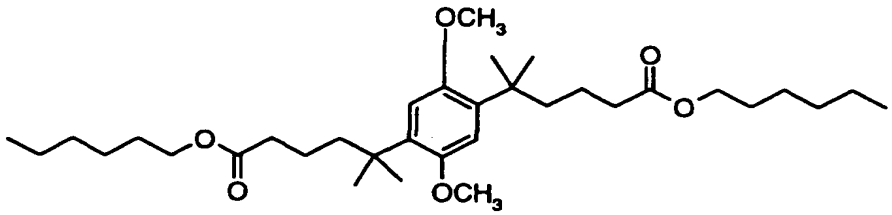


(AVIII)

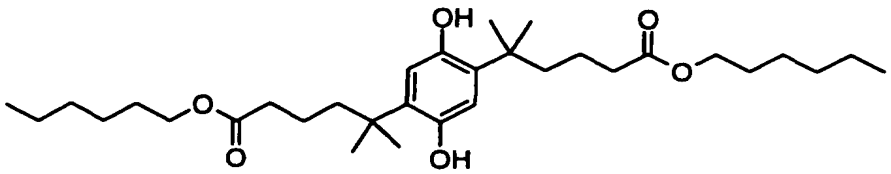
Other substances which can be used as light or dark stabilizers are described in US-A-5,580,710 or US-A-5,543,276.

Examples of particularly suited stabilizers for the colour couplers and resulting dyes which can be employed in the novel material are:

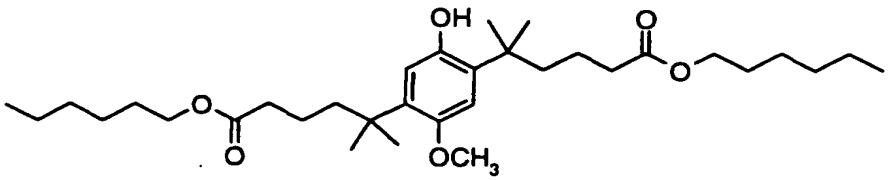
(ST-1)



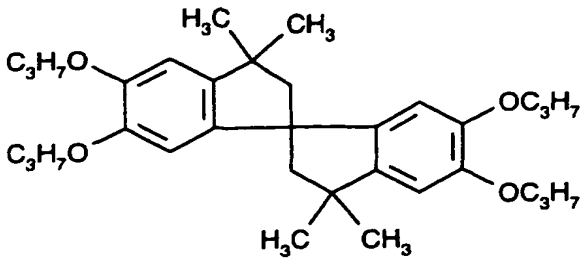
(ST-2)



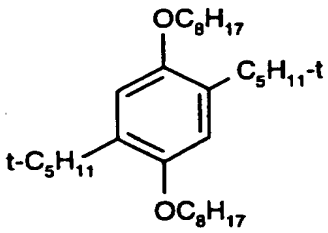
(ST-3)



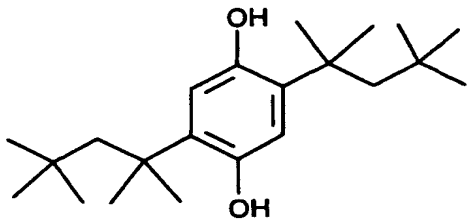
(ST-4)



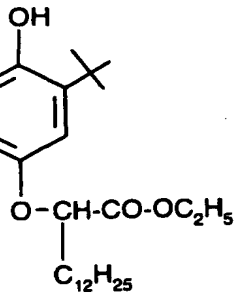
(ST-5)



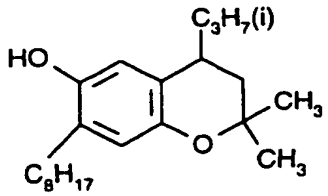
(ST-6)



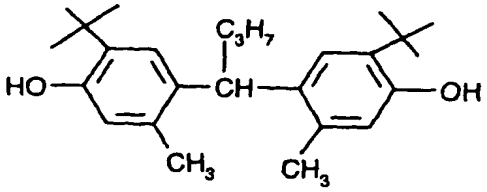
(ST-7)



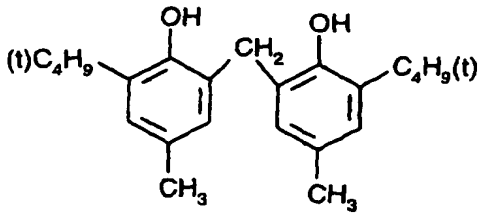
(ST-8)



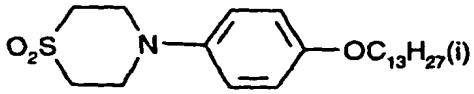
(ST-9)



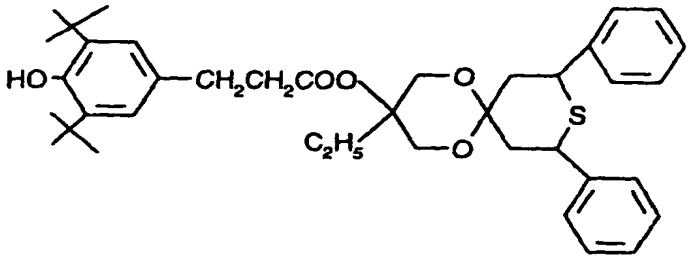
(ST-10)



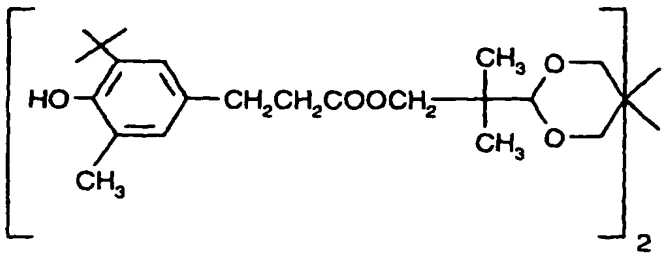
(ST-11)



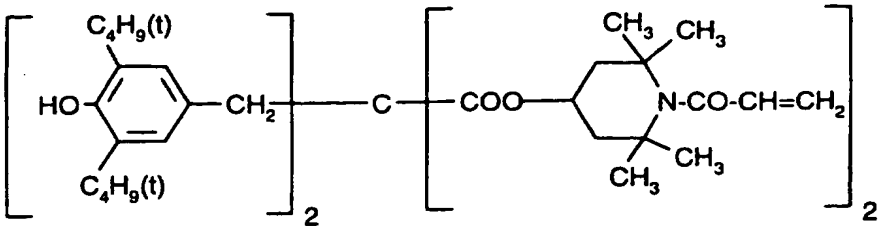
(ST-12)



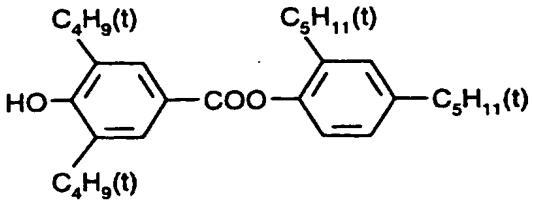
(ST-13)



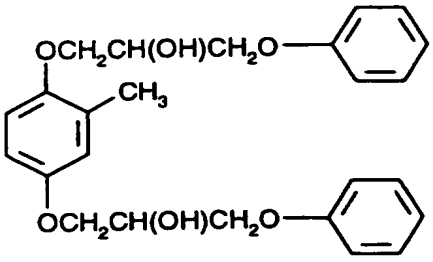
(ST-14)



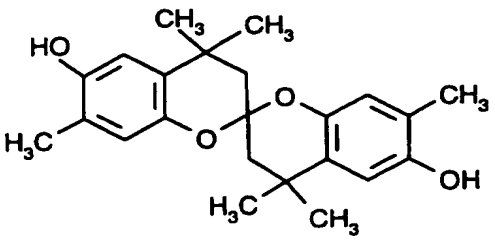
(ST-15)



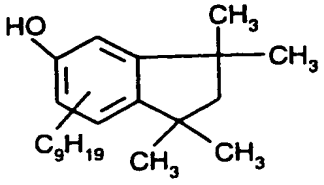
(ST-16)



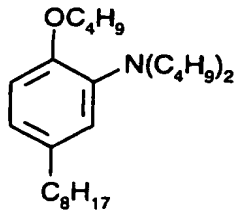
(ST-17)



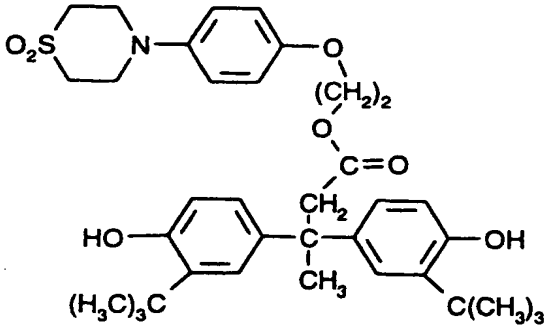
(ST-18)



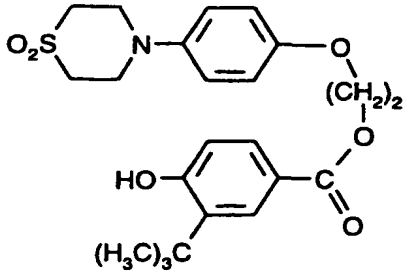
(ST-19)



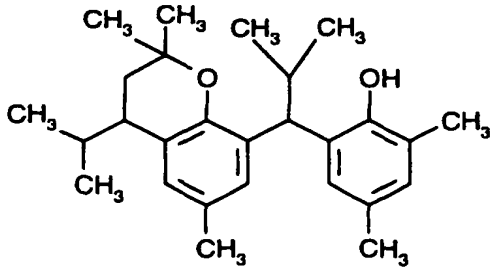
(ST-20)



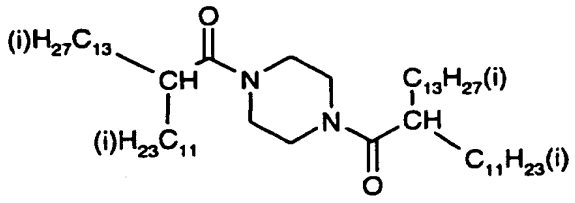
(ST-21)



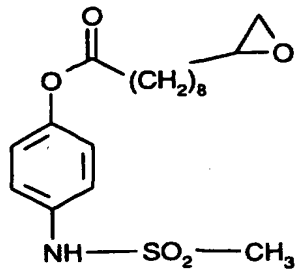
(ST-22)



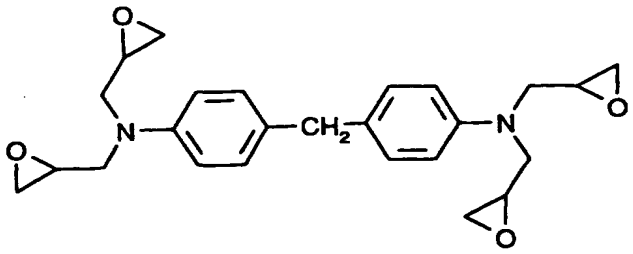
(ST-23)



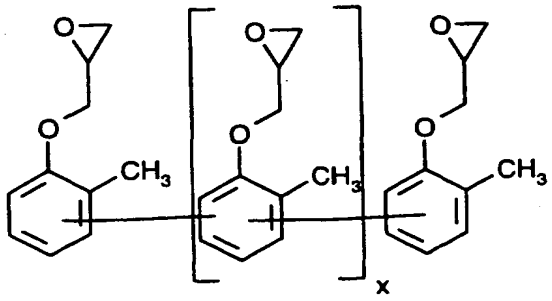
(ST-24)



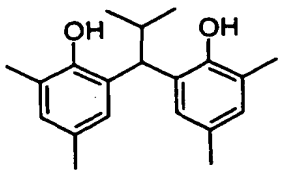
(ST-25)

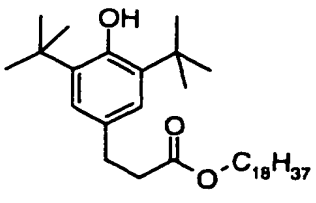


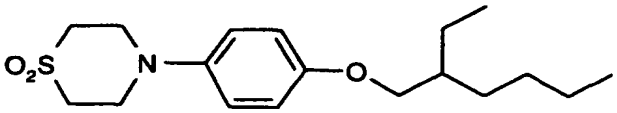
(ST-26)



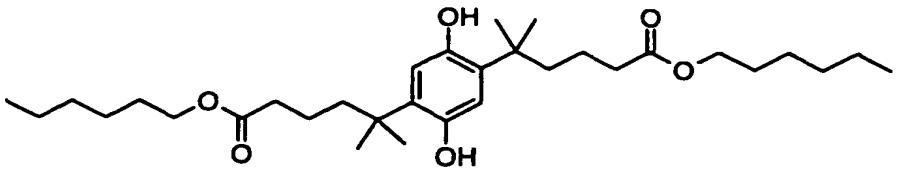
(ST-27)

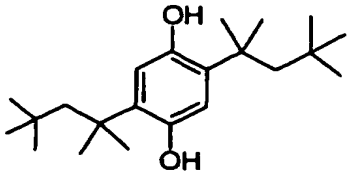


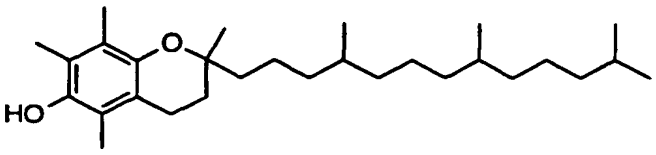
(ST-28) 

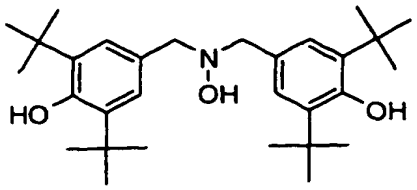
(ST 29) 

The compounds of formula I may be used in combination with any known Dox scavengers such as hydrazines, hydrazides, hydroquinones of e.g. formula A-1 or A-2, 6-hydroxychromans of e.g formula A-3 or hydroxylamines of e.g. formula A-4:

A-1 

A-2 

A-3 

A-4 

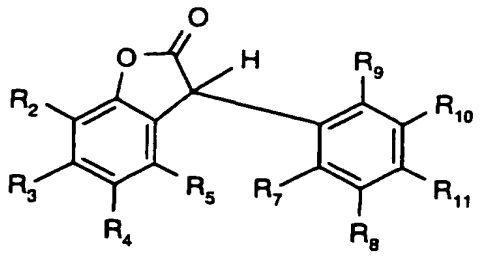
As silver halide emulsions it is possible to use customary silver chloride, silver bromide or silver iodide emulsions or mixtures thereof, such as silver chlorobromide and silver chloroiodide emulsions, in which the silver halides may have all known crystal forms. The use of silver chloride emulsions is accorded particular importance in the material of this novel process. The preparation of such emulsions and their sensitization are described in research disclosure, Item 307105, November 1989.

The silver halide emulsion which can be used to implement this invention can be sensitized for all desired wavelengths, with the aid of sensitizing dyes. Dyes which can be used for this purpose are cyanine dyes, merocyanine dyes, holopolar dyes, hemicyanine dyes, styryl dyes or hemioxonol dyes.

The photosensitive material may include water-soluble filter and antihalation dyes. Dyes which can be used for this purpose are oxonol dyes, hemioxonol dyes, styryl dyes, merocyanine dyes, cyanine dyes, anthraquinone dyes and azo dyes.

Further details on the structure of the colour photographic material of the invention, and the components or further additives which can be employed in the novel material, can be found, inter alia, in US-A-5,538,840, column 27, line 25, to column 106, line 16, and in US-A-5,780,625, column 12, line 6, until column 57, line 6, and the publications cited in these 2 references; these passages of US-A-5,538,840 and US-A-5,780,625 are hereby incorporated by reference. Other useful information, how compounds of the formula I can be used in photographic material, can be taken from DE-A-19749083, page 16, line 35, until page 17, line 45, especially the references cited therein. Further important components, especially couplers, are described in US-5,578,437; GB-A-2319523 describes from page 49, line 21, until page 73, line 2, further details of the colour photographic material, especially couplers (page 52, line 1, until page 56, line 22), UV absorbers (page 56, line 25, until page 68, line 1) and dark stabilisers (page 68, line 2, until page 73, line 2).

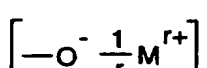
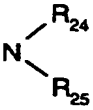
Some of the compounds of the formula I are new compounds. Thus, this invention also pertains to a compound of the formula V

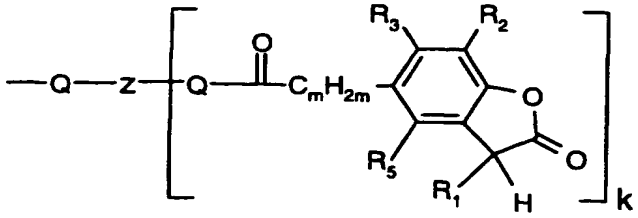


(V),

wherein

R_4 is $-(CH_2)_s-COR'_{15}$ or $-C_pH_{2p}-COR_{15}$ or $-C_tH_{2t}-COR_{15}$, wherein the alkylene moiety C_pH_{2p} is branched alkylene and the alkylene moiety C_tH_{2t} is a straight chain or branched alkylene moiety;

R_{15} is hydroxy,  , C_1-C_{20}alkoxy,  , or a group of the formula IIIa



(IIIa);

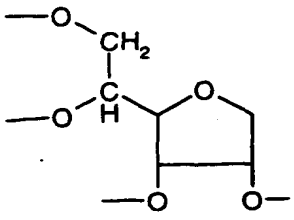
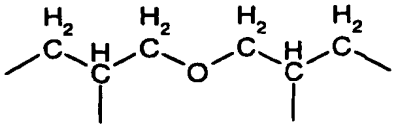
R'_{15} is a group of formula IIIa;

Q is oxygen or -NH-,

Z is a linking group of valency (k+1) and is as a divalent group C_2-C_{12}alkylene, Q-interrupted C_4-C_{12}alkylene, phenylene or phenylene-D-phenylene with D being C_1-C_4alkylene, O, S, SO or SO_2;

Z as a trivalent group is C_3-C_{12}alkanetriyl, a trivalent residue of a hexose or a hexitol, a group $(-CH_2)_3C-CH_2OH$, or a group $-C_aH_{2a}-N(C_bH_{2b}-)-C_cH_{2c}-$; and

Z as a tetravalent group is a tetravalent residue of a hexose or a hexitol, C_4-C_{12}alkanetetryl,

a group  or a group  ;

a, b, c and k independently are 1, 2 or 3,

m is 0 or a number from the range 1-12, preferably 1-6,

p is 1 or 2;

s is 1 or 2;

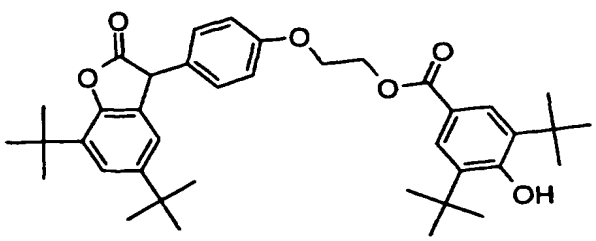
t is a number from the range 3-12, preferably 3-6;

and all other residues are as defined for formula I if n is 1.

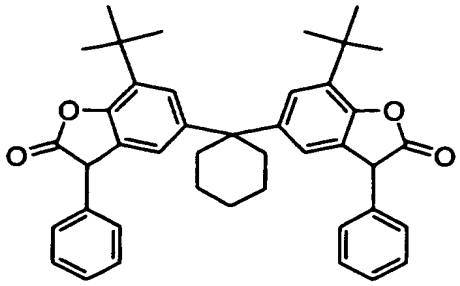
Preferred compounds of the formula V are, within the limits given, as defined for formulae I or IV above.

Compounds of the formula V are also useful as stabilisers for organic material against degradation by light, oxygen and/or heat. Application of these compounds and methods of stabilising are generally as described in GB-A-2322861; examples for organic material which can be stabilized are listed, for example, in GB-A-2319523 from page 15, line 11, until page 20, line 25; possible costabilizers are as listed, for example, in GB-A-2319523 from page 21, line 16, until page 32, bottom line. Compounds of the formula V are used for this application preferably in an amount of 0.0005 to 5%, based on the weight of the organic material to be stabilised.

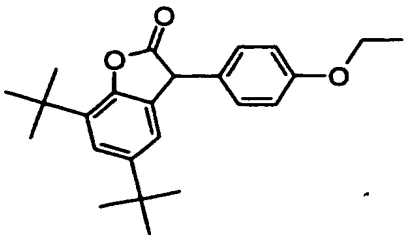
Examples for compounds of the formula I to be used within this invention are:

Compound 1[a]: 

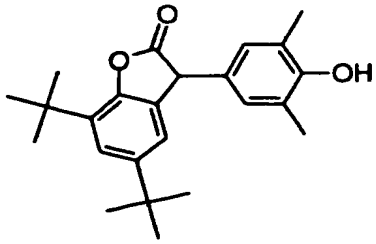
Compound 2:



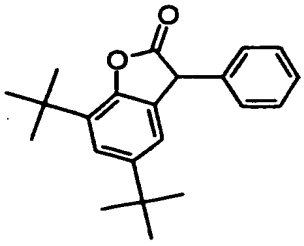
Compound 3 [a]:



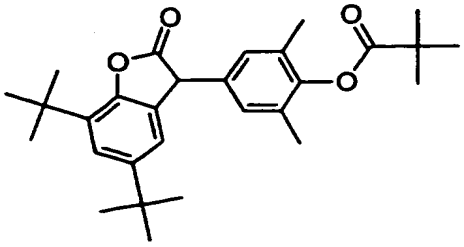
Compound 4 [a]:



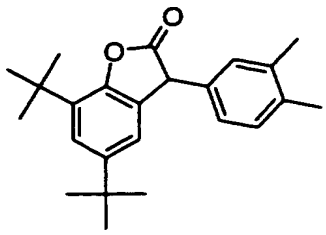
Compound 5:



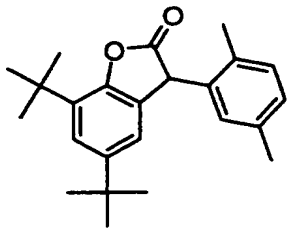
Compound 6 [a]:



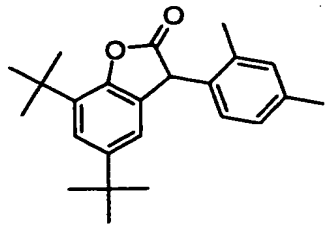
Compound 7 [a)]:



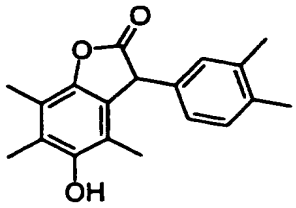
Compound 8:



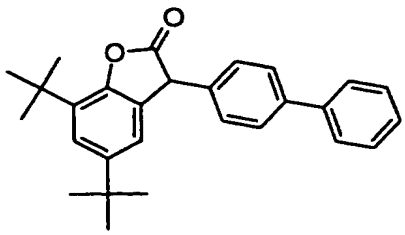
Compound 9 [a)]:



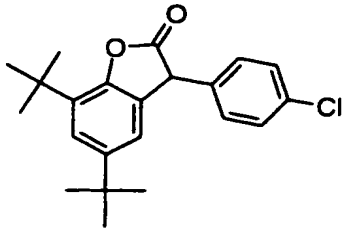
Compound 10 [a)]:



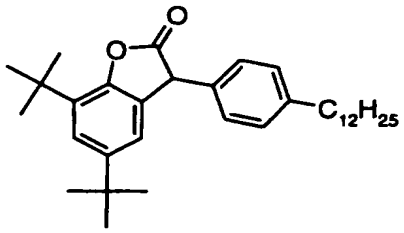
Compound 11 [a)]:



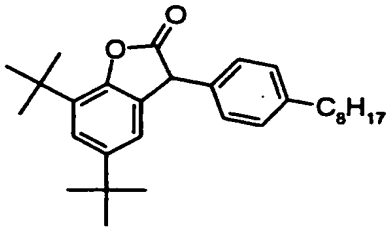
Compound 12 [a)]:



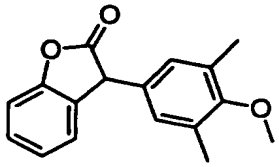
Compound 13 [a)]:



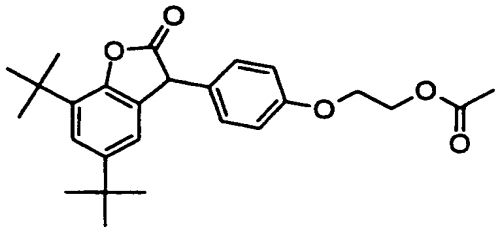
Compound 14 [a)]:



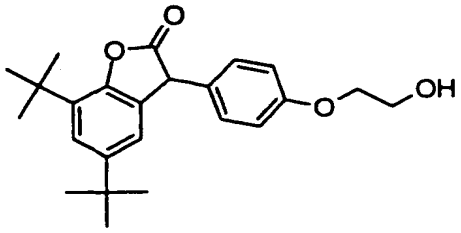
Compound 15 [a)]:



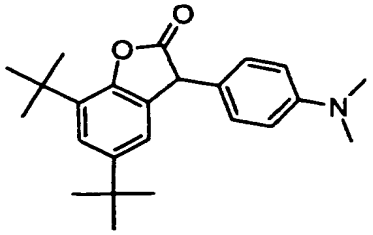
Compound 16 [a)]:



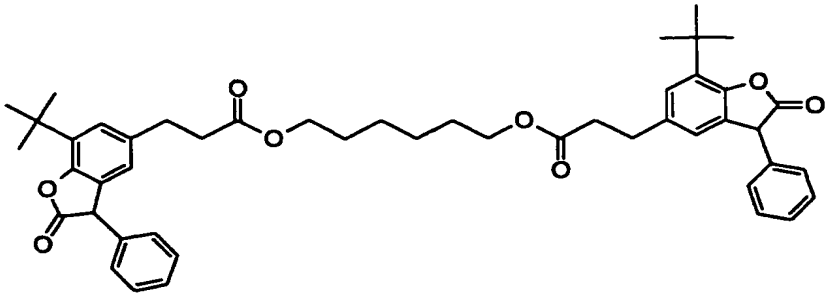
Compound 17 [a)]:



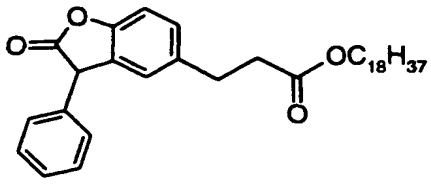
Compound 18 [a)]:



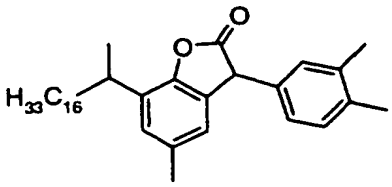
Compound 19:



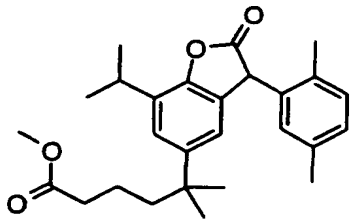
Compound 20:



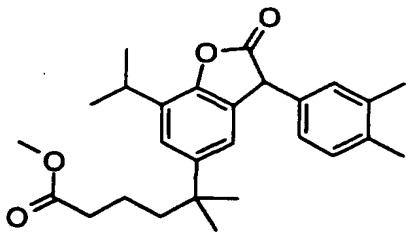
Compound 21 [a)]:



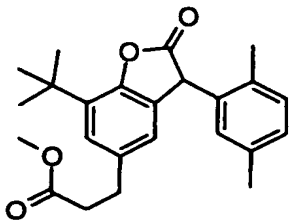
Compound 22:



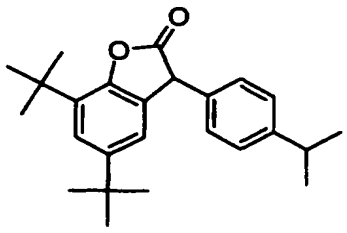
Compound 23 [a)]:



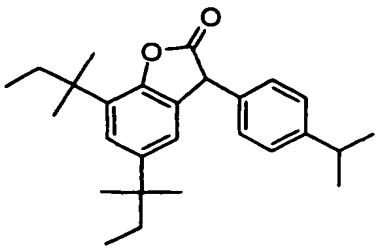
Compound 24:



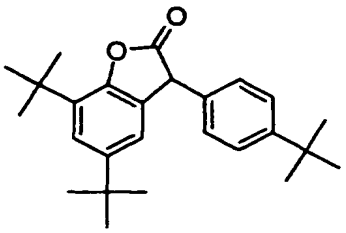
Compound 25 [a)]:



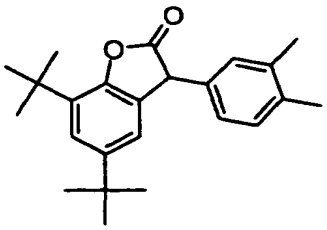
Compound 26 [a)]:



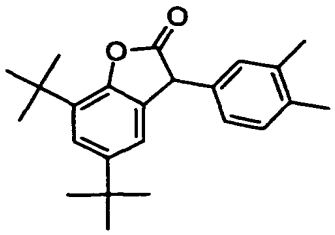
Compound 27 [a]:

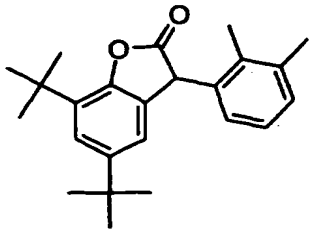


Compound 28:



a) The product may additionally contain minor amounts of other structural isomers in accordance with the substitution at the phenyl ring in 3-position of the benzofuran-2-one. For example, compound 7 comprises the 2 isomers





The synthetic methods used for the preparation of the benzofuran-2-ones shown above are described e.g. in US Patent 5,516,920.

Example 1

To evaluate compounds of this invention with respect to their ability as interlayer scavengers for oxidised developing agent, three layer photographic test elements are prepared by providing layers in the order indicated on a polyethylene-coated paper support :

Test element 1 (r ferenc sampl)

(1) A layer containing :

- 1800 mg.m^{-2} of gelatin
- 180 mg.m^{-2} of dibutylphtalate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

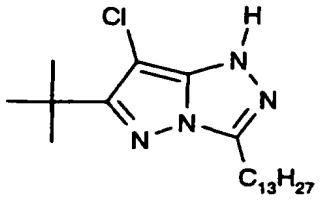
(2) An interlayer containing :

- 1800 mg.m^{-2} of gelatin
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer containing :

- 260 mg.m^{-2} (based on silver) of an unsensitized silver bromide emulsion
- 1800 mg.m^{-2} of gelatin
- 300 mg.m^{-2} of magenta-dye-forming coupler M-1
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 2-hydroxy-4,6-dichloro-1,3,5-triazine, potassium salt hardener
- 7-methyl-5-hydroxy-1,3,8-triazaindolizine antifoggant.

M-1



Test element 2 (check sample)

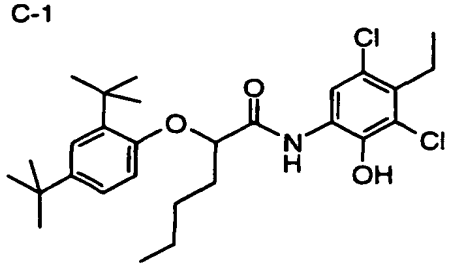
(1) A layer containing :

- 1800 mg.m^{-2} of gelatin
- 272 mg.m^{-2} of cyan-dye-forming coupler C-1
- 180 mg.m^{-2} of dibutylphtalate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(2) An interlayer having the same composition as the interlayer of test element 1

(3) A photosensitive layer having the same composition as the photosensitive layer of test element 1.

C-1



T st elements 3-8

(1) A layer having the same composition as the first layer of test element 2

(2) An interlayer containing

- 1800 mg.m^{-2} of gelatin
- 0.056x10^{-3} mol.m^{-2} of oxidised developer scavenger as indicated in table 1 below
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer having the same composition as the photosensitive layer of test element 1.

The test elements are imagewise exposed through a step wedge with density increment 0.15 and thereafter subjected to the AGFA P-94 developing process.

Within test elements 2-9, cyan dye can only be formed by the wandering of the oxidised developer from the layer in which it is formed (i.e. the uppermost layer) to the bottom layer containing the cyan-dye-forming coupler. The ability of an interlayer scavenger to prevent oxidised developer from diffusing into the bottom layer can thus be assessed by determining the red density at any chosen exposure amount.

The red density at the exposure amount giving a green density of 2 is reported in table 1. The red density in the test element containing no cyan coupler in the bottom layer (test element 1) arises exclusively from the side absorption of the magenta dye in the red part of the visible spectrum.

Table 1

Test element	Interlayer scavenger	Red density at a green density of 2
1 (reference)	none	0.268
2 (check)	none	0.400
3	Compound 1	0.320
4	Compound 2	0.278
5	Compound 3	0.349
6	Compound 4	0.313
7	Compound 5	0.327
8	Compound 6	0.319

Any red density inferior to that observed in sample 2 indicates scavenging of the oxidised developer. It is thus clear from the data in table 1 that compounds within the scope of this invention are very effective in preventing the oxidised developer from wandering and forming dye in the wrong layer.

Example 2

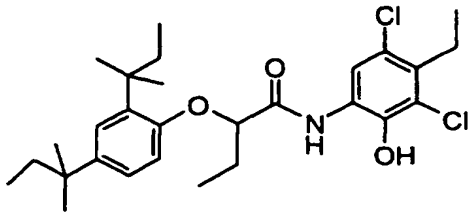
Three layer photographic test elements are prepared by providing layers in the order indicated on a polyethylene-coated paper support :

Test element 9 (reference sample)
Same as test element 1 of example 1

Test element 10 (check sample)
(1) A layer containing :
- 1800 $mg.m^{-2}$ of gelatin
- 272 $mg.m^{-2}$ of cyan-dye-forming coupler C-2
- 180 $mg.m^{-2}$ of dibutylphtalate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(2) An interlayer having the same composition as the interlayer of test element 9
(3) A photosensitive layer having the same composition as the photosensitive layer of test element 9.

C-2



Test elements 11-14

(1) A layer having the same composition as the first layer of test element 10

(2) An interlayer containing

- 1800 $mg.m^{-2}$ of gelatin
- 30 $mg.m^{-2}$ of oxidised developer scavenger as indicated in table 2 below
- 300 $mg.m^{-2}$ of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer having the same composition as the photosensitive layer of test element 9.

The test elements are exposed and processed in the same manner as in example 1.

The red density at the exposure amount giving a green density of 2 is reported in table 2.

Table 2

Test element	Interlayer scavenger	Red density at a green density of 2
9 (reference)	none	0.264
10 (check)	none	0.372
11	Compound 7	0.284
12	Compound 8	0.308
13	Compound 9	0.300
14	Compound 24	0.302

According to the data in table 2, the compounds of this invention used in the test elements 11-14 are very effective oxidised developer scavengers.

Example 3

Three layer photographic test elements are prepared by providing layers in the order indicated on a polyethylene-coated paper support :

Test element 15 (check sample)

(1) A layer containing :
- 1800 mg.m^{-2} of gelatin
- 272 mg.m^{-2} of cyan-dye-forming coupler C-2
- 180 mg.m^{-2} of dibutylphtalate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(2) An interlayer containing :
- 1800 mg.m^{-2} of gelatin
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer containing :
- 260 mg.m^{-2} of an unsensitized silver bromide emulsion
- 1800 mg.m^{-2} of gelatin
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 2-hydroxy-4,6-dichloro-1,3,5-triazine, sodium salt hardener
- 7-methyl-5-hydroxy-1,3,8-triazaindolizine antifoggant.

Test elements 16-27

(1) A layer having the same composition as the first layer of test element 15

(2) An interlayer containing
- 1800 mg.m^{-2} of gelatin
- 30 mg.m^{-2} of oxidised developer scavenger as indicated in table 3 below
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer having the same composition as the photosensitive layer of test element 15.

The test elements are given a stepped exposure and processed as in example 1.

Cyan dye formation within the above described test elements will again only result from the wandering of the oxidised developer from the photosensitive layer to the layer containing the cyan-dye-forming coupler. The ability of an interlayer scavenger to prevent oxidised developer from diffusing into the bottom layer can thus be assessed by measuring the red density at any given exposure.

As the above described samples contain no dye-forming coupler in the photosensitive layer, there is almost no consumption of the oxidised developer within the latter and the flux of oxidised developer through the interlayer towards the layer containing the cyan coupler is thus markedly increased as compared to the samples of examples 1 and 2.

In table 3, $(D_{red})_{1.35}$ is the red density at the exposure amount obtained behind the 1.35 density step of the step wedge. With the test elements 1-14, this exposure amount gives a green density of about 1.9. The smaller the $(D_{red})_{1.35}$ value, the more effective the scavenging of the oxidised developer.

Table 3

Test element	Interlayer Scavenger	$(D_{red})_{1.35}$
15 (check)	none	0.405
16	Compound 7	0.282
17	Compound 10	0.250
18	Compound 11	0.309
19	Compound 12	0.292
20	Compound 13	0.318
21	Compound 14	0.324
22	Compound 15	0.335
23	Compound 16	0.300
24	Compound 18	0.314
25	Compound 19	0.335
26	Compound 20	0.344
27	Compound 21	0.314

From the data in table 3, it can be seen again that 3-aryl-3H-benzofuran-2-ones according to this invention exhibit outstanding scavenging ability, as evidenced by much smaller red density values in the test elements 16-27 as compared to the check sample.

Example 4

Three layer photographic test elements are prepared by providing layers in the order indicated on a polyethylene-coated paper support :

Test element 28 (reference sample)

(1) A layer containing :
- 1800 $mg.m^{-2}$ of gelatin
- 180 $mg.m^{-2}$ of dibutylphtalate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(2) An interlayer containing :
- 1800 $mg.m^{-2}$ of gelatin
- 300 $mg.m^{-2}$ of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer containing :
- 260 $mg.m^{-2}$ of an unsensitized silver bromide emulsion
- 1800 $mg.m^{-2}$ of gelatin
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 2-hydroxy-4,6-dichloro-1,3,5-triazine, sodium salt hardener
- 7-methyl-5-hydroxy-1,3,8-triazaindolizine antifoggant.

Test element 29 (check sample)

Same as test element 15 of example 3 except that the cyan coupler used was C-1 instead of C-2.

Test elements 30-33

(1) A layer having the same composition as the first layer of test element 29

(2) An interlayer containing

- 1800 mg.m^{-2} of gelatin
- Oxidised developer scavenger as indicated in table 4 below
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent

(3) A photosensitive layer having the same composition as the photosensitive layer of test element 29.

The test elements are given a stepped exposure and processed as in example 1.

In table 4, $(D_{red})_{1.05}$ is the red density at the exposure amount obtained behind the 1.05 density step of the step wedge. For test elements 1-14, this exposure amount gives a green density of about 2.4. The smaller the $(D_{red})_{1.05}$ value, the more effective the scavenging of the oxidised developer.

Table 4

Test element	Interlayer Scavenger	Concentration	$(D_{red})_{1.05}$
28 (reference)	none	-	0.080
29 (check)	none	-	0.482
30	Compound 7	30 mg.m^{-2}	0.390
31	Compound 7	60 mg.m^{-2}	0.313
32	Compound 7	90 mg.m^{-2}	0.202
33	Compound 7	120 mg.m^{-2}	0.127

From the data in table 4, it can be seen that compound 7 according to this invention effectively prevents the formation of cyan dye, and that the Dox scavenging effect increases in proportion to the amount of added compound.

Example 5

Three layer photographic test elements are prepared by providing layers in the order indicated on a polyethylene-coated paper support :

Test element 34 (check sample)

(1) A layer containing :

- 1800 mg.m^{-2} of gelatin
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent.

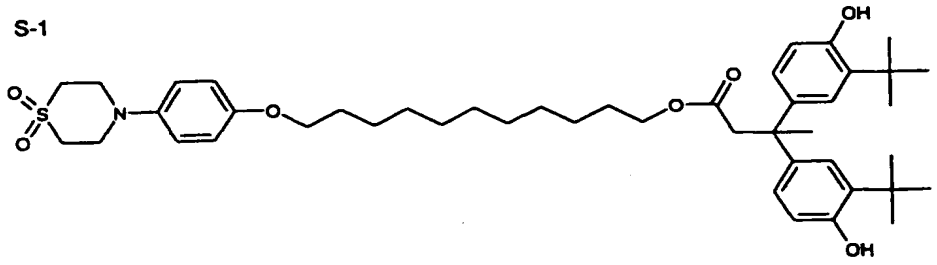
(2) A photosensitive layer containing :

- 260 mg.m^{-2} (based on silver) of an unsensitized silver bromide emulsion
- 1800 mg.m^{-2} of gelatin
- 300 mg.m^{-2} of magenta-dye-forming coupler M-1 (see example 1)
- 225 mg.m^{-2} of the magenta dye light stabiliser S-1 (see below)
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 7-methyl-5-hydroxy-1,3,8-triazaindolizine antifoggant.

(3) A layer containing :

- 1800 mg.m^{-2} of gelatin
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 2-hydroxy-4,6-dichloro-1,3,5-triazine, potassium salt hardener.

S-1



Test elements 35-39

(1) A layer containing :

- 1800 mg.m^{-2} of gelatin
- 80 mg.m^{-2} of oxidised developer scavenger as indicated in table 5 below
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent.

(2) A photosensitive layer having the same composition as the photosensitive layer of test element 34 .

(3) A layer containing :

- 1800 mg.m^{-2} of gelatin
- 80 mg.m^{-2} of oxidised developer scavenger as indicated in table 5 below
- 300 mg.m^{-2} of tricresylphosphate
- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 2-hydroxy-4,6-dichloro-1,3,5-triazine, potassium salt hardener.

The test elements are imagewise exposed through a step wedge with density increment 0.30 and thereafter subjected to the AGFA P-94 developing process.

In order to evaluate them for light fastness, the stepped magenta images obtained in this manner are irradiated through an ultraviolet filter in an Atlas device equiped with a 3500 W Xenon lamp.

In a second experiment, magenta images obtained in the above described way are stored in the dark at 60°C, 95%RH for 72 hours prior to light exposure in the Atlas device.

In all cases the light fastness of the magenta image is evaluated based on the percentage of the residual dye density after 30 kJ/cm^2 of light exposure (initial density = 1). The results are given in table 5.

Table 5

Test element	Interlayer Scavenger	Residual dye after 30 kJ.cm^{-2} of Atlas exposure (%)	
		no dark storage (60°C, 95% RH) prior to irradiation in the Atlas	72 h dark storage (60°C, 95% RH) prior to irradiation in the Atlas
34 (check)	none	75	75
35 (comparison)	A-1	74	60
36 (comparison)	A-2	71	45
37	Compound 7	76	77
38	Compound 12	77	74
39	Compound 21	75	75

From the data in table 5, it can be seen that the oxidised developer scavengers according to this invention are not detrimental at all to the light resistance of the magenta layer, whether the samples are subjected to a preliminary dark storage period at 60°C, 95%RH or not. In contrast, the comparison hydroquinone scavengers A-1 and A-2 clearly impair the light fastness of the magenta image after the samples had been left under a high temperature and humidity for 72 hours.

Example 6

Test element 40 is prepared by providing on a polyethylene-coated paper support a light-sensitive silver halide layer containing:

- 260 mg.m^{-2} (based on silver) of an unsensitized silver bromide emulsion
- 5150 mg.m^{-2} of gelatin
- 305 mg.m^{-2} of magenta-dye-forming compound M-1
- 305 mg.m^{-2} of tricresylphosphate

- 2-sulfonate-4,8-diisobutyl-naphtalene, sodium salt surface active agent
- 2-hydroxy-4,6-dichloro-1,3,5-triazine, potassium salt hardener
- 7-methyl-5-hydroxy-1,3,8-triazaindolizine antifoggant

Test elements 41 and 42 are prepared identically to test element 40, except that the emulsion layer additionally contains 30 $mg.m^{-2}$ and 75 $mg.m^{-2}$ of compound 7, respectively.

The prepared test elements are imagewise exposed through a step wedge with density increment 0.30 and thereafter subjected to the AGFA P-94 developing process.
The stepped magenta images obtained in this manner are irradiated through an ultraviolet filter in an Atlas device equiped with a 3500 W Xenon lamp.

The light fastness of the magenta image is evaluated based on the percentage of the residual dye density after 15 kJ/cm^2 of light exposure (initial density = 1). The results are given in table 6.

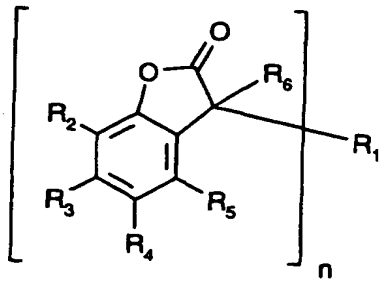
Table 6

Test element	Benzofuranone	Residual dye after 15 $kJ.cm^{-2}$ of Atlas exposure (%)
40 (control)	none	31
41	compound 7 (30 $mg.m^{-2}$)	48
42	compound 7 (75 $mg.m^{-2}$)	77

As compared to a layer without added benzofuranone, magenta layers containing compound 7 are much more stable to light. Thus, the benzofuranone derivatives according to this invention can also find utility as light stabilisers for magenta dyes derived from pyrazolo:azole couplers.

Claims:

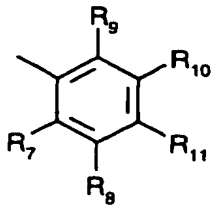
1. Process for preventing migration of the oxidised developer in a colour photographic material from one colour sensitive layer to another by incorporating a compound of the formula I into said material



(I),

wherein, if n = 1,

R_1 is naphthyl, phenanthryl, anthryl, 5,6,7,8-tetrahydro-2-naphthyl, 5,6,7,8-tetrahydro-1-naphthyl, thienyl, benzo[b]thienyl, naphtho[2,3-b]thienyl, thianthrenyl, dibenzofuryl, chromenyl, xanthenyl, phenoxathiinyl, pyrrolyl, imidazolyl, pyrazolyl, pyrazinyl, pyrimidinyl, pyridazinyl, indolizinyl, isoindolyl, indolyl, indazolyl, purinyl, quinolizinyl, isoquinolyl, quinolyl, phthalazinyl, naphthyridinyl, quinoxalinyl, quinazolinyl, cinnolinyl, pteridinyl, carbazolyl, β-carbolinyl, phenanthridinyl, acridinyl, perimidinyl, phenanthrolinyl, phenazinyl, isothiazolyl, phenothiazinyl, isoxazolyl, furazanyl, biphenyl, terphenyl, fluorenyl or phenoxazinyl, each of which is unsubstituted or substituted by C_1-C_4alkyl, C_1-C_4alkoxy, C_1-C_4alkylthio, hydroxy, halogen, amino, C_1-C_4alkylamino, phenylamino or di(C_1-C_4-alkyl)amino, or R_1 is a radical of formula II



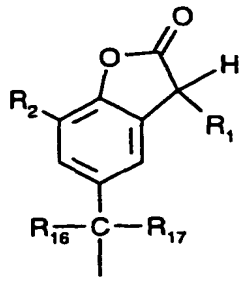
(II),

and, if n = 2,

R_1 is unsubstituted or C_1-C_4alkyl- or hydroxy-substituted phenylene or naphthylene; or $-R_{12}-X-R_{13}-$,

R_2, R_3, R_4 and R_5 are each independently of one another hydrogen, chloro, hydroxy, C_1-C_{25}-alkyl, C_7-C_9phenylalkyl, unsubstituted or C_1-C_4alkyl-substituted phenyl; unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkyl; C_1-C_{18}alkoxy, C_1-C_{18}alkylthio, C_1-C_4alkylamino, di(C_1-C_4-alkyl)amino, C_1-C_{25}alkanoyloxy, C_1-C_{25}alkanoylamino, C_3-C_{25}alkenoyloxy;

C_3-C_{25}alkanoyloxy which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_6-C_9cycloalkyl-carbonyloxy, benzoyloxy or C_1-C_{12}alkyl-substituted benzoyloxy; or R_2 and R_3, or R_3 and R_4, or R_4 and R_5, together with the linking carbon atoms, form a benzene ring; or R_4 is $-C_mH_{2m}-COR_{15}$ or $-(CH_2)_qOH$ or, if R_3, R_5 and R_6 are hydrogen, R_4 is additionally a radical of formula III

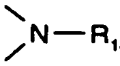


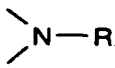
(III),

wherein R_1 is as defined above for n = 1;

R_6 is hydrogen or, when R_4 is hydroxy, R_6 can also be C_1-C_{25}alkyl or C_3-C_{25}alkenyl;

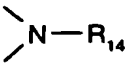
R_7, R_8, R_9, R_{10} and R_{11} are each independently of one another hydrogen, halogen, hydroxy, C_1-C_{25}alkyl; C_2-C_{25}alkyl which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_1-C_{25}alkoxy; C_2-C_{25}alkoxy which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_1-C_{25}alkylthio, C_3-C_{25}-alkenyl, C_3-C_{25}alkenyloxy, C_3-C_{25}alkynyl, C_3-C_{25}alkynyloxy, C_7-C_9phenylalkyl, C_7-C_9phenylalkoxy, unsubstituted or C_1-C_4alkyl-substituted phenyl; unsubstituted or C_1-C_4alkyl- substituted phenoxy; unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkyl; unsubstituted or C_1-C_4alkyl-substituted C_5-C_8cycloalkoxy; C_1-C_4alkylamino, di(C_1-C_4alkyl)amino, C_1-C_{25}alka-

noyl; C_3-C_{25}alkanoyl which is interrupted by oxygen, sulfur or  ; C_1-C_{25}alkanoyl-

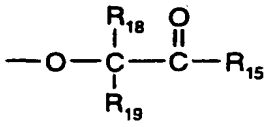
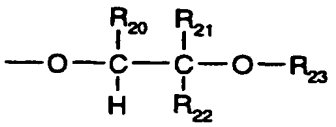
oxy; C_3-C_{25}alkanoyloxy which is interrupted by oxygen, sulfur or  ; C_1-C_{25}alka-

noylamino, C_3-C_{25}alkenoyl; C_3-C_{25}alkenoyl which is interrupted by oxygen, sulfur or

 ; C_3-C_{25}alkenoyloxy; C_3-C_{25}alkenoyloxy which is interrupted by oxygen, sulfur or

 ; C_6-C_9cycloalkylcarbonyl, C_6-C_9cycloalkylcarbonyloxy, benzoyl or C_1-C_{12}alkyl-

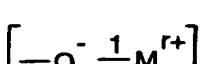
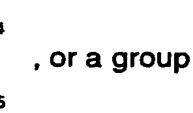
substituted benzoyl; benzoyloxy or C_1-C_{12}alkyl-substituted benzoyloxy;

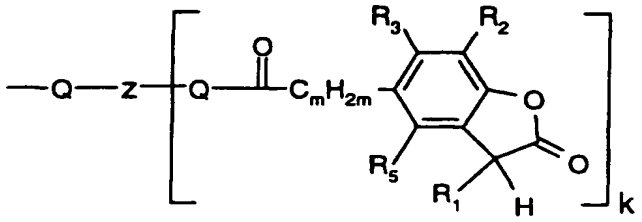
 or  or, in formula II, R_7 and R_8, or R_8 and

R_{11}, together with the linking carbon atoms, form a benzene ring,

R_{12} and R_{13} are each independently of the other unsubstituted or C_1-C_4alkyl-substituted phenylene or naphthylene,

R_{14} is hydroxy or C_1-C_8alkyl,

R_{15} is hydroxy,  , C_1-C_{20}alkoxy,  , or a group of the formula IIIa

 (IIIa);

R_{16} and R_{17} are each independently of the other hydrogen, CF_3, C_1-C_{12}alkyl or phenyl, or R_{16} and R_{17}, together with the linking carbon atom, are a C_5-C_8cycloalkylidene ring which is unsubstituted or substituted by 1 to 3 C_1-C_4alkyl;

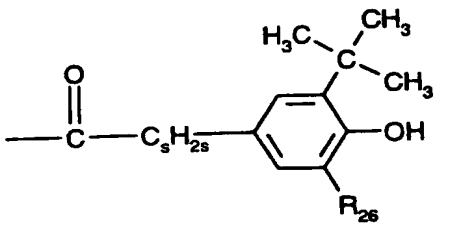
R_{18} and R_{19} are each independently of the other hydrogen, C_1-C_4alkyl or phenyl,

R_{20} is hydrogen or C_1-C_4alkyl,

R_{21} is hydrogen, unsubstituted or C_1-C_4alkyl-substituted phenyl; C_1-C_{25}alkyl; C_2-C_{25}alkyl which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_7-C_9phenylalkyl which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C_1-C_4alkyl; C_7-C_{25}phenylalkyl which is interrupted by oxygen, sulfur or $>N-R_{14}$ and which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C_1-C_4alkyl, or R_{20} and R_{21}, together with the linking carbon atoms, form a C_5-C_{12}cycloalkylene ring which is unsubstituted or substituted by 1 to 3 C_1-C_4alkyl;

R_{22} is hydrogen or C_1-C_4alkyl,

R_{23} is hydrogen, C_1-C_{25}alkanoyl, C_3-C_{25}alkenoyl; C_3-C_{25}alkanoyl which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_2-C_{25}alkanoyl which is substituted by a di(C_1-C_6alkyl)phosphonate group; C_6-C_9cycloalkylcarbonyl, thenoyl, furoyl, benzoyl or C_1-C_{12}alkyl-substituted benzoyl;



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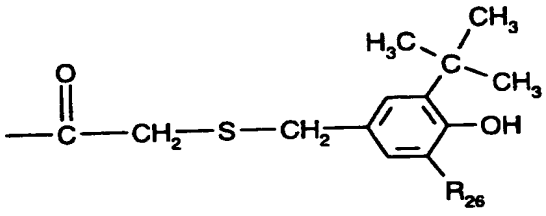

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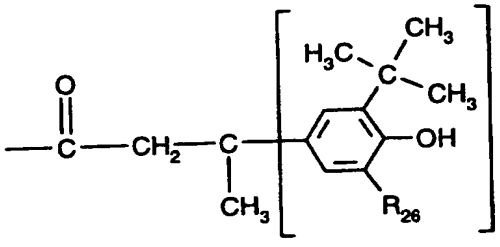

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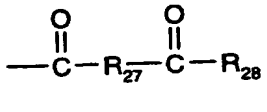
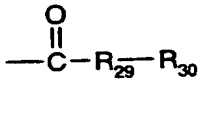


or



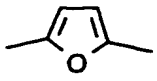
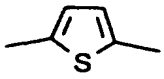
,

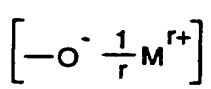
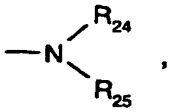
R_{24} and R_{25} are each independently of the other hydrogen or C_1-C_{18}alkyl,

R_{26} is hydrogen or C_1-C_8alkyl,

R_{27} is a direct bond, C_1-C_{18}alkylene; C_2-C_{18}alkylene which is interrupted by oxygen, sulfur or $>N-R_{14}$; C_2-C_{18}alkenylene, C_2-C_{20}alkylidene, C_7-C_{20}phenylalkylidene, C_5-C_8cycloalky-

lene, C_7-C_8bicycloalkylene, unsubstituted or C_1-C_4alkyl-substituted phenylene,

 or  ,

R_{28} is hydroxy,  , C_1-C_{18}alkoxy or  ,

R_{29} is oxygen or -NH-,

R_{30} is C_1-C_{18}alkyl or phenyl,

R_{31} is hydrogen or C_1-C_{18}alkyl,

M is an r-valent metal cation,

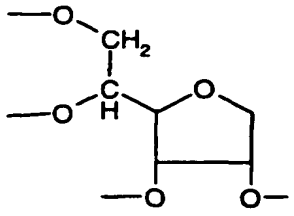
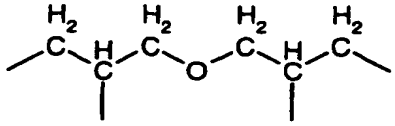
Q is oxygen or -NH-,

X is a direct bond, oxygen, sulfur or $-NR_{31}-$,

Z is a linking group of valency (k+1) and is as a divalent group C_2-C_{12}alkylene, Q-interrupted C_4-C_{12}alkylene, phenylene or phenylene-D-phenylene with D being C_1-C_4alkylene, O, S, SO or SO_2;

Z as a trivalent group is C_3-C_{12}alkanetriyl, a trivalent residue of a hexose or a hexitol, a group $(-CH_2)_3C-CH_2OH$, or a group $-C_aH_{2a}-N(C_bH_{2b}-)-C_cH_{2c}-$; and

Z as a tetravalent group is a tetravalent residue of a hexose or a hexitol, C_4-C_{12}alkanetetryl,

a group  or a group  ;

a, b, c and k independently are 1, 2 or 3,

m is 0 or a number from the range 1-12, preferably 1-6,

n is 1 or 2,

q is 1, 2, 3, 4, 5 or 6,

r is 1, 2 or 3, and

s is 0, 1 or 2;

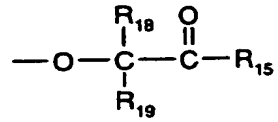
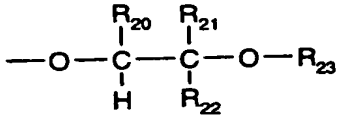
provided that, when R_7 is hydroxy, alkanoyloxy or alkanoyloxy interrupted by O, S or $N(R_{14})$ and R_9 is hydrogen, R_{10} is not identical with R_4; and when R_9 is hydroxy, alkanoyloxy or alkanoyloxy interrupted by O, S or $N(R_{14})$ and R_7 is hydrogen, R_8 is not identical with R_4.

2. Process according to claim 1, wherein in the compound of formula I

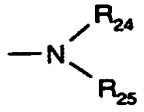
R_2, R_3 and R_5 , independently, are H, Cl, hydroxy, C_1-C_{25}alkyl, C_7-C_9phenylalkyl, unsubstituted or C_1-C_4alkyl-substituted phenyl; C_1-C_{18}alkoxy, C_1-C_{25}alkanoyloxy, C_3-C_{25}alkenoyloxy; and where

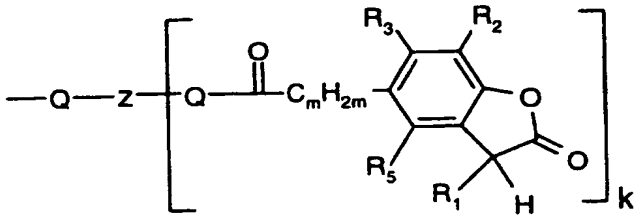
R_4 is Cl, hydroxy, C_1-C_{25}alkyl, C_7-C_9phenylalkyl, unsubstituted or C_1-C_4alkyl-substituted phenyl; C_1-C_{18}alkoxy, C_1-C_{25}alkanoyloxy, C_3-C_{25}alkenoyloxy or is a group $-C_mH_{2m}-COR_{15}$, or where R_3, R_5 and R_6 are H, R_4 may be a residue of formula III, or where R_8 or R_{10} are other than H, R_4 may also be hydrogen;

R_6 is H,

R_7, R_8, R_9, R_{10} and R_{11} independently are H, halogen, hydroxy, C_1-C_{25}alkyl, O interrupted C_2-C_{25}alkyl; C_1-C_{25}alkoxy, O interrupted C_2-C_{25}alkoxy, C_3-C_{25}alkenyl, C_3-C_{25}alkenyloxy, C_7-C_9phenylalkyl, C_7-C_9phenylalkoxy, unsubstituted or C_1-C_4alkyl-substituted phenyl; unsubstituted or C_1-C_4alkyl substituted phenoxy; unsubstituted or C_1-C_4alkyl substituted C_5-C_8cycloalkyl; unsubstituted or C_1-C_4alkyl substituted C_5-C_8cycloalkoxy; C_1-C_4alkylamino, di-(C_1-C_4-alkyl)amino, C_1-C_{25}alkanoyl; C_1-C_{25}alkanoyloxy; C_6-C_9cycloalkylcarbonyl, C_6-C_9cycloalkylcarbonyloxy, benzoyl or C_1-C_{12}alkyl-substituted benzoyl; benzoyloxy or C_1-C_{12}alkyl substituted benzoyloxy;  or  , or

where in formula II R_7 and R_8 or R_8 and R_{11} together with the carbon atoms, they are bonded to, form a phenyl ring;

R_{15} is C_1-C_{18}alkoxy or  or a group of formula IIIa;

 (IIIa);

R_{16} and R_{17} independently are H, CF_3, C_1-C_{12}alkyl or phenyl; or R_{16} and R_{17} together with the bonding carbon atom form an unsubstituted or 1-3 C_1-C_4alkyl-substituted C_5-C_8cycloalkylidene ring;

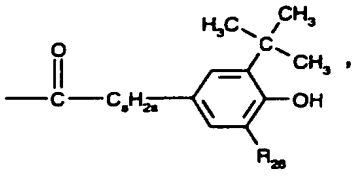
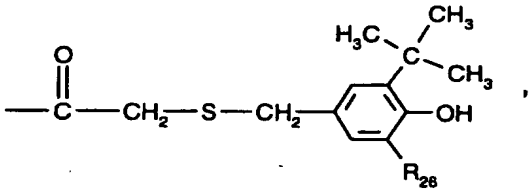
R_{18} andR_{19} independently are H, C_1-C_4alkyl or phenyl;

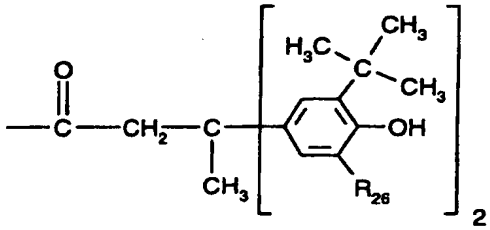
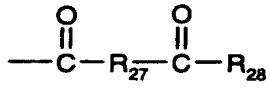
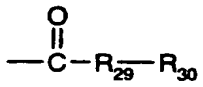
R_{20} is H or C_1-C_4alkyl;

R_{21} is H, unsubstituted or C_1-C_4alkyl substituted phenyl; C_1-C_{25}alkyl, unsubstituted or on the phenyl ring 1-3 C_1-C_4alkyl-substituted C_7-C_9phenylalkyl;

R_{22} is H or C_1-C_4alkyl;

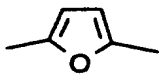
R_{23} is H, C_1-C_{25}alkanoyl, C_3-C_{25}alkenoyl; di(C_1-C_6alkyl)phosphonate-substituted C_2-C_{25}alkanoyl; C_6-C_9cycloalkylcarbonyl, thenoyl, furoyl, benzoyl or C_1-C_{12}alkyl-substituted

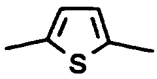
benzoyl;  ,  ,

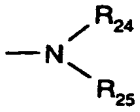
 ,  or  ;

R_{24} and R_{25} independently are H or C_1-C_{18}alkyl;

R_{26} is H or C_1-C_8alkyl;

R_{27} is a direct bond, C_1-C_{18}alkylen, C_2-C_{18}alkenylen, C_7-C_{20}phenylalkyliden, C_5-C_8cycloalkylen, unsubstituted or C_1-C_4alkyl-substituted phenylene,  or

 ;

R_{28} C_1-C_{18}alkoxy or  ;

R_{29} is O or -NH-;

R_{30} C_1-C_{18}alkyl or phenyl:

M a metal cation of the valency r;

X a direct bond, O, S or -NR_{31}- ;

n 1 or 2;

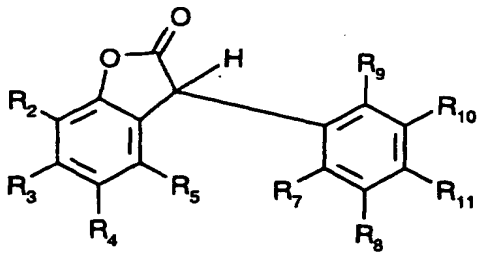
m is a number from the range 1-8;

q 1, 2, 3, 4, 5 or 6;

r 1, 2 or 3; and

s is 0, 1 or 2.

3. Process according to claim 1 wherein the compound of formula I corresponds to the formula IV



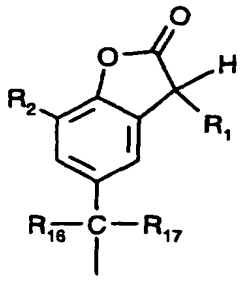
(IV)

wherein

R_2 is H or C_1-C_{20}alkyl;

R_3 is H or C_1-C_{18}alkyl;

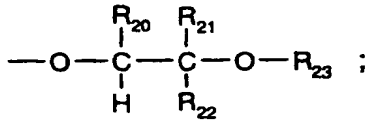
R_4 is C_1-C_8alkyl, H, C_1-C_6alkoxy or a group $-C_mH_{2m}-COR_{15}$ or a group of the formula III



(III);

R_5 is H or C_1-C_{18}alkyl;

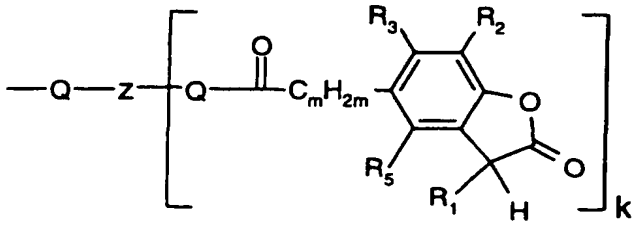
R_7, R_8, R_9, R_{10} and R_{11} independently are H, OH, chloro, C_1-C_{18}alkyl, C_1-C_{18}alkoxy, di(C_1-C_4alkyl)amino, phenyl, C_2-C_{18}alkanoyloxy, C_3-C_{18}-alkoxycarbonylalkoxy or



;

especially wherein at least 2 of the residues R_7, R_8, R_9, R_{10}, R_{11} are H;

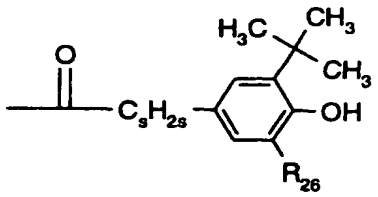
R_{15} is C_1-C_{18}alkoxy or a group of the formula IIIa



(IIIa);

R_{16} and R_{17} independently are H, C_1-C_{12}alkyl or phenyl; or R_{16} and R_{17} together with the bonding carbon atom form a C_5-C_8cycloalkylidene ring;

R_{20}, R_{21} and R_{22} independently are H or C_1-C_4alkyl;

R_{23} is H, C_2-C_{18}alkanoyl or a group 

R_{26} is C_1-C_4alkyl;

Q is oxygen;

Z is C_2-C_{12}alkylene;

k is 1;

m is 1, 2, 3, 4, 5 or 6 and

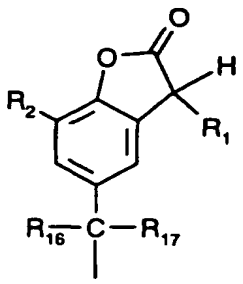
s is 0, 1 or 2.

4. Process according to claim 3 wherein in the compound of formula IV

R_2 is C_1-C_{20}alkyl;

R_3 is H or C_1-C_{18}alkyl;

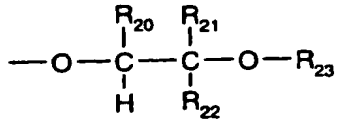
R_4 is C_1-C_6alkyl, C_1-C_6alkoxy or a group $-C_mH_{2m}-COR_{15}$ or a group of the formula III



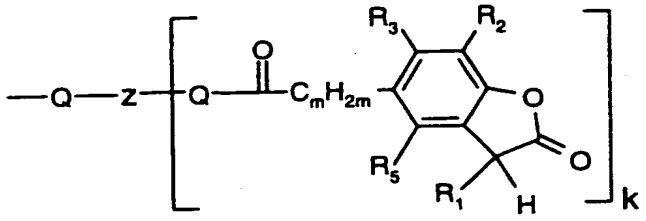
(III);

R_5 is H or C_1-C_{18}alkyl;

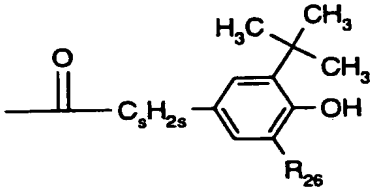
R_7 and R_9 independently are H, chloro, C_1-C_{18}alkyl;

R_8, R_{10} and R_{11} independently are H, OH, chloro, C_1-C_{18}alkyl, C_1-C_{18}alkoxy, di(C_1-C_4alkyl)amino, phenyl, C_2-C_{18}alkanoyloxy or  ;

R_{15} is C_1-C_{18}alkoxy or a group of the formula IIIa

 (IIIa);

R_{20}, R_{21} and R_{22} are H;

R_{23} is H, C_2-C_{18}alkanoyl or a group 

R_{26} is C_1-C_4alkyl;

Q is oxygen;

Z is C_2-C_{12}alkylene;

k is 1;

m is 1, 2, 3, 4, 5 or 6 and

s is 0, 1 or 2.

5. Process according to claim 3 where in the compound of formula IV R_7 is H and R_9 is H or methyl and wherein R_2, R_3, R_4, R_5, R_6, R_8, R_9, R_{10}, and R_{11} together contain at least 3 carbon atoms.

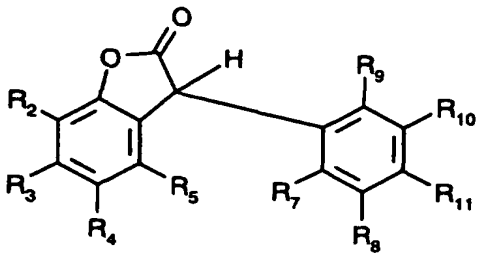
6. Process according to claim 3 wherein in the compound of formula IV, R_4 is C_1-C_6alkyl, especially tertiary C_4-C_6alkyl, or a group $-C_mH_{2m}-COR_{15}$ or a group of the formula III.

7. Process according to claim 1, wherein the compound of formula I is incorporated into the colour photographic material in an amount from 10 to 1000 mg/m^2.

8. Process according to claim 1, wherein the compound of formula I is concentrated in one or more interlayers separating the light sensitive layers of the colour photographic material.

9. Use of a compound of the formula I according to claim 1 as a scavenger for the oxidized developer in a colour photographic material.

10. A colour photographic material containing a compound of the formula IV



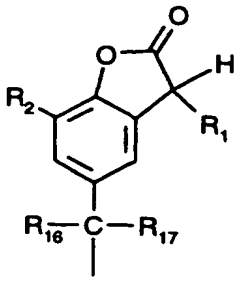
(IV)

wherein

R_2 is H or C_1-C_{20}alkyl;

R_3 is H or C_1-C_{18}alkyl;

R_4 is C_1-C_8alkyl, C_1-C_6alkoxy or a group -C_mH_{2m}-COR_{15} or a group of the formula III

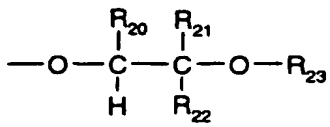


(III);

R_5 is H or C_1-C_{18}alkyl;

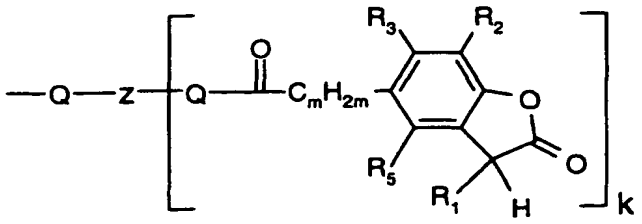
R_7 and R_9 independently are H, chloro, C_1-C_{18}alkyl or phenyl;

R_8, R_{10} and R_{11} independently are H, OH, chloro, C_1-C_{18}alkyl, C_1-C_{18}alkoxy, di(C_1-C_4alkyl)amino, phenyl, C_2-C_{18}alkanoyloxy, C_3-C_{18}-alkoxycarbonylalkoxy or



;

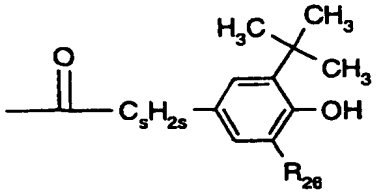
R_{15} is C_1-C_{18}alkoxy or a group of the formula IIIa



(IIIa);

R_{16} and R_{17} independently are H, C_1-C_{12}alkyl or phenyl; or R_{16} and R_{17} together with the bonding carbon atom form a C_5-C_8cycloalkylidene ring;

R_{20}, R_{21} and R_{22} independently are H or C_1-C_4alkyl;

R_{23} is H, C_2-C_{18}alkanoyl or a group 

R_{26} is C_1-C_4alkyl;

Q is oxygen;

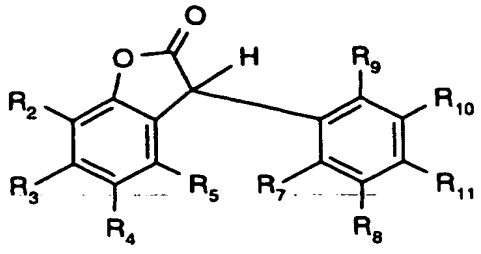
Z is C_2-C_{12}alkylene;

k is 1;

m is 1, 2, 3, 4, 5 or 6 and

s is 0, 1 or 2.

11. Use of a compound of the formula IV according to claim 11 as an additive in a colour photographic material.

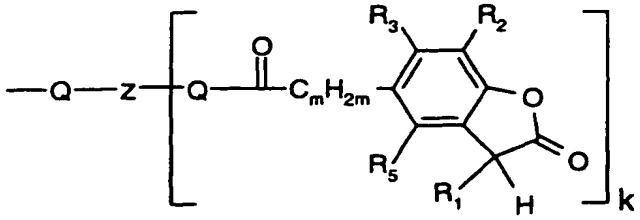
12. Compound of the formula V: 

(V),

wherein

R_4 is $-(CH_2)_s-COR'_{15}$ or $-C_pH_{2p}-COR_{15}$ or $-C_tH_{2t}-COR_{15}$, wherein the alkylene moiety C_pH_{2p} is branched alkylene and the alkylene moiety C_tH_{2t} is a straight chain or branched alkylene moiety;

R_{15} is hydroxy, $\left[-O^- \frac{1}{r} M^{r+}\right]$, C_1-C_{20}alkoxy, $-N(R_{24})(R_{25})$, or a group of the formula IIIa



(IIIa);

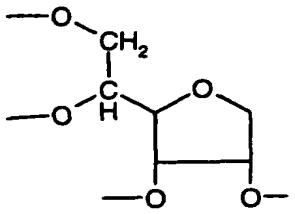
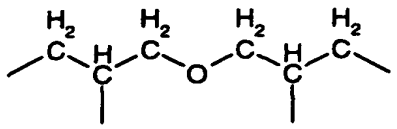
R'_{15} is a group of formula IIIa;

Q is oxygen or -NH-,

Z is a linking group of valency (k+1) and is as a divalent group C_2-C_{12}alkylene, Q-interrupted C_4-C_{12}alkylene, phenylene or phenylene-D-phenylene with D being C_1-C_4alkylene, O, S, SO or SO_2;

Z as a trivalent group is C_3-C_{12}alkanetriyl, a trivalent residue of a hexose or a hexitol, a group $(-CH_2)_3C-CH_2OH$, or a group $-C_aH_{2a}-N(C_bH_{2b}-)-C_cH_{2c}-$; and

Z as a tetravalent group is a tetravalent residue of a hexose or a hexitol, C_4-C_{12}alkanetetryl,

a group  or a group  ;

a, b, c and k independently are 1, 2 or 3,

m is 0 or a number from the range 1-12, preferably 1-6,

p is 1 or 2;

s is 1 or 2;

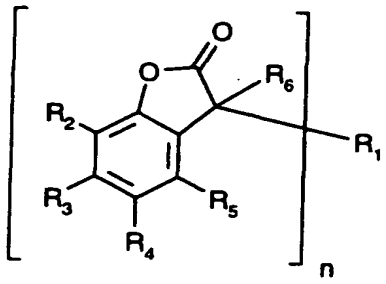
t is a number from the range 3-12, preferably 3-6;

and all other residues are as defined in claim 1 for formula I if n is 1.

13. Use of a compound of the formula V according to claim 14 as stabilizer for organic material against deterioration by light, oxygen and/or heat.

Abstract

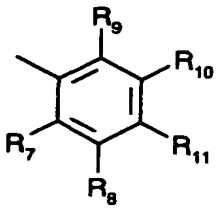
A colour photographic material is described containing a compound of the formula I



(I),

wherein, if n = 1,

R_1 is, inter alia, a radical of formula II



(II),

and, if n = 2,

R_1 is unsubstituted or C_1-C_4alkyl- or hydroxy-substituted phenylene or naphthylene; or $-R_{12}-X-R_{13}-$, and other residues are as defined in claim 1. The compound of the formula I is effective as scavenger of the oxidised form of the developer (Dox scavenger), especially when contained in an interlayer between light sensitive layers. Selected compounds of this class can also be used as additives, for example as dye stabilizer, in colour photographic materials.